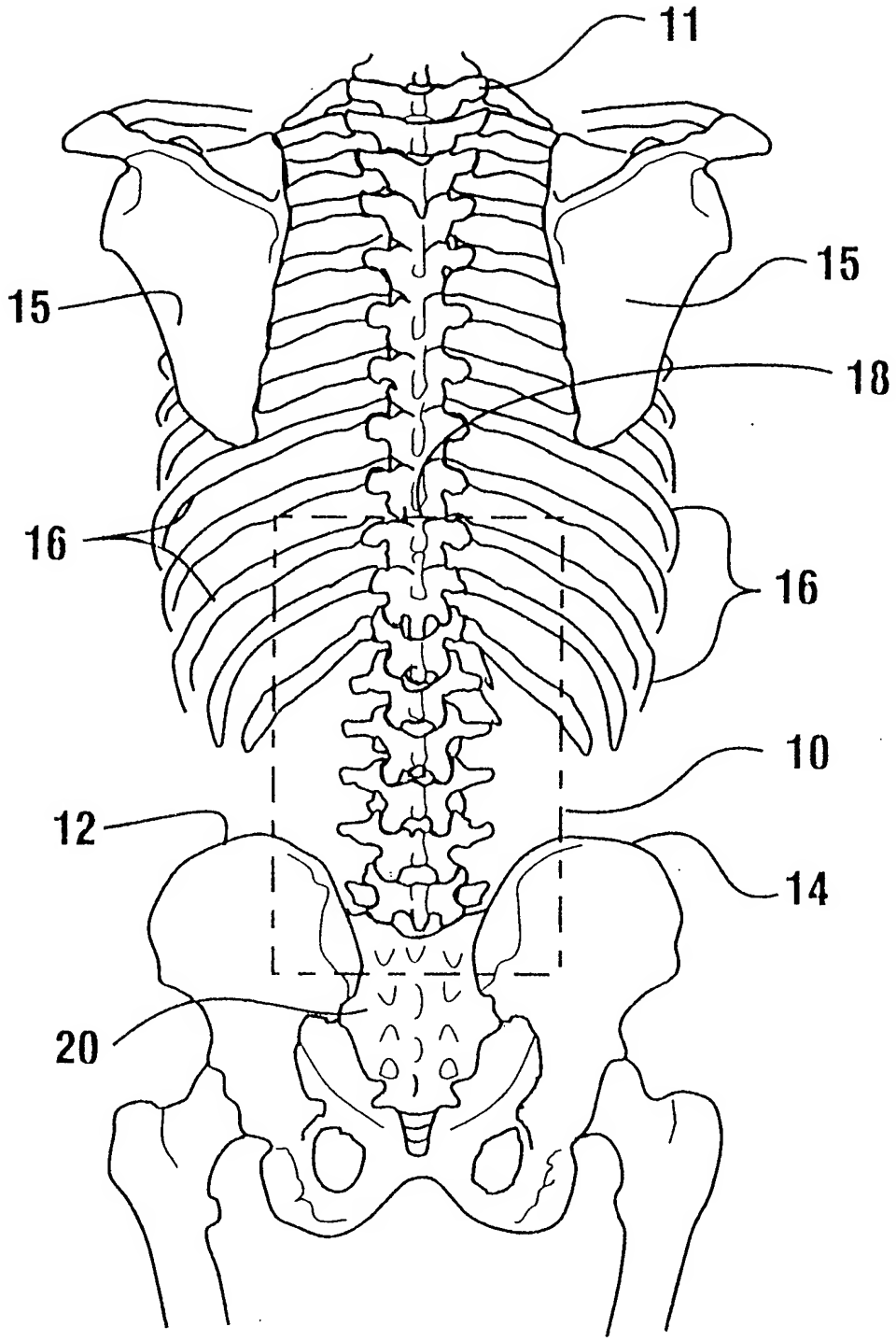
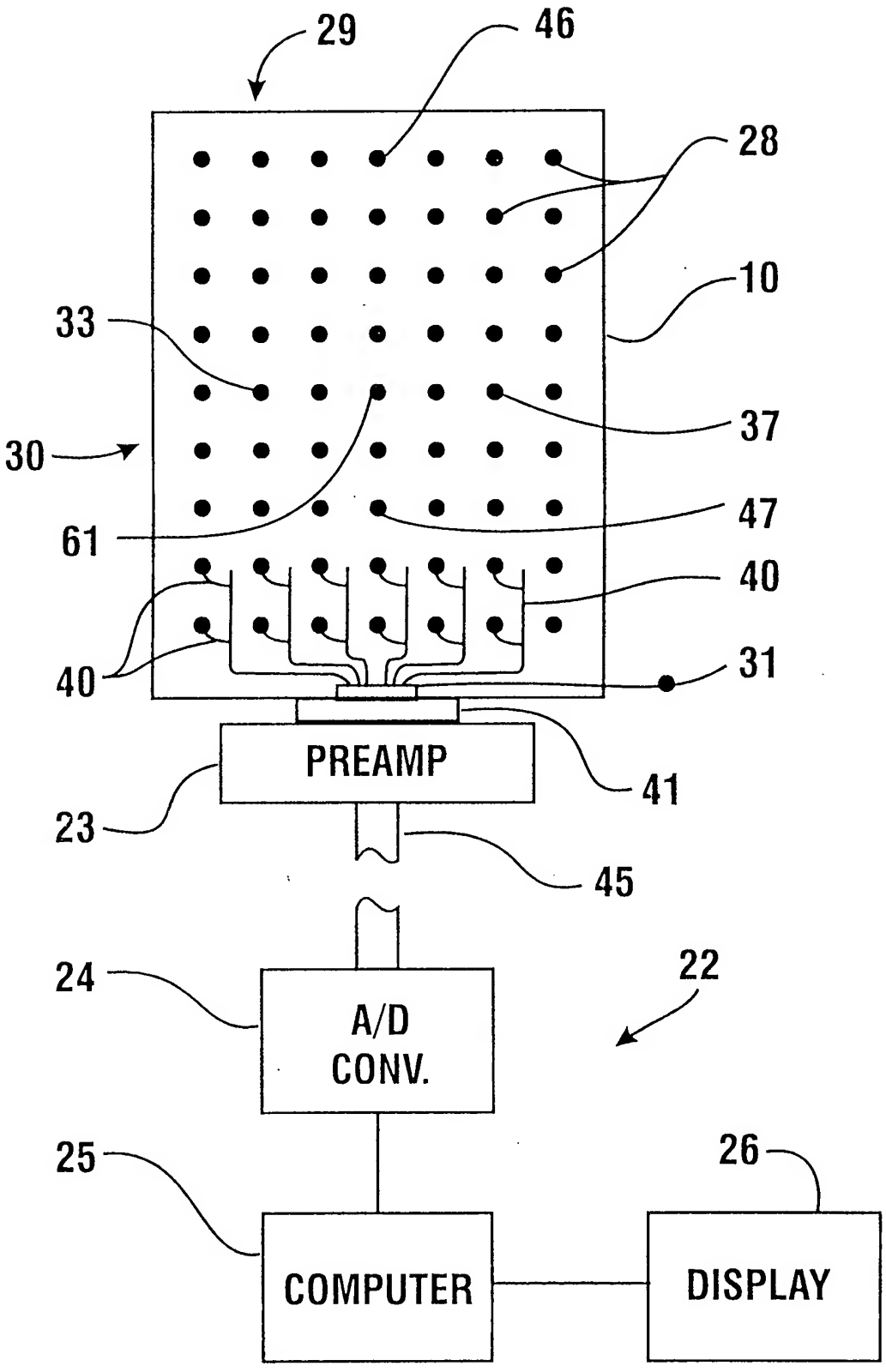


FIG. 1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PREAMP
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A/D
CONV.
25
26
COMPUTER
DISPLAY

FIG. 2

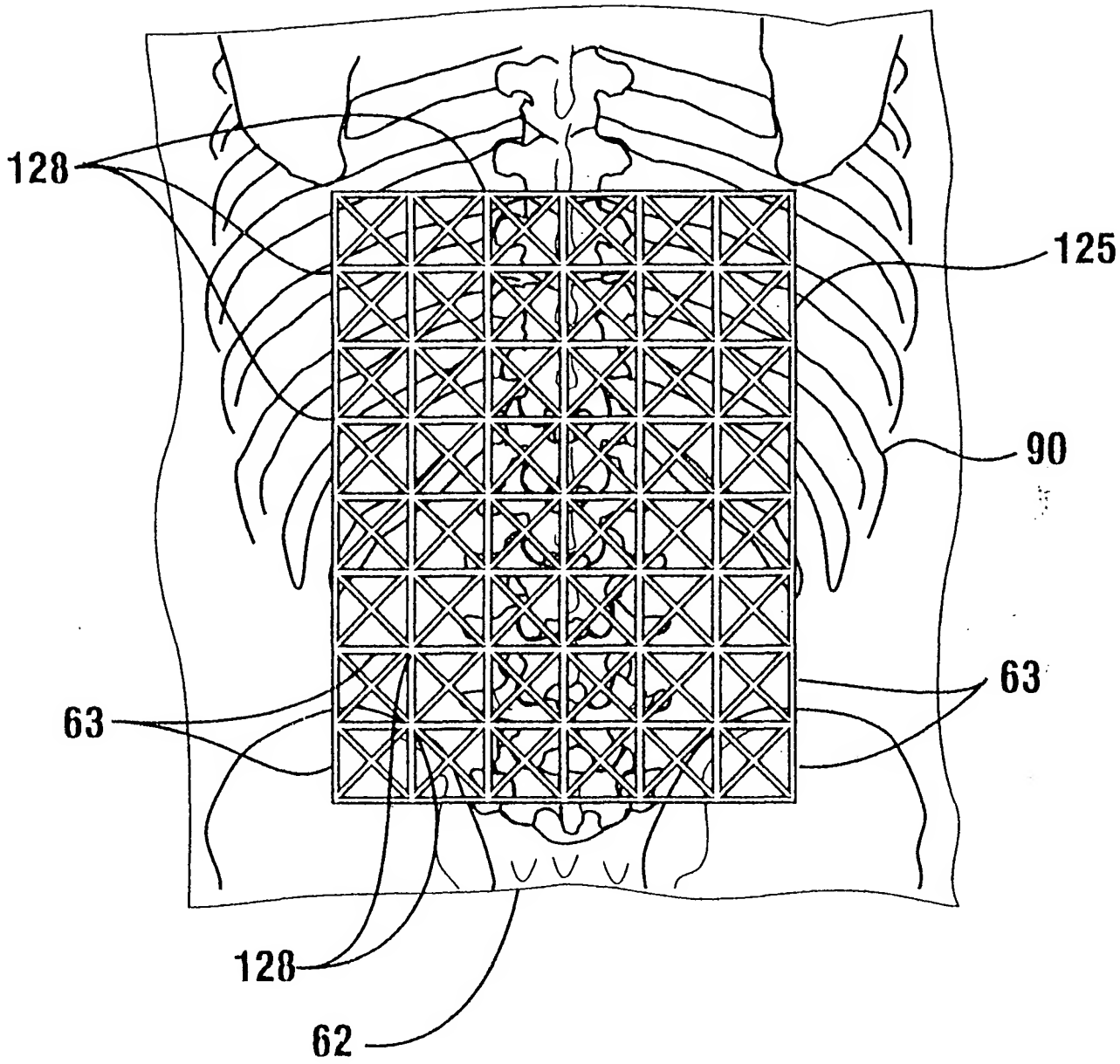

FIG. 3

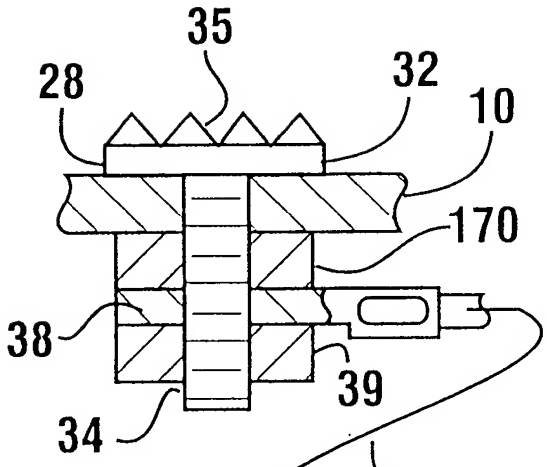

FIG. 4

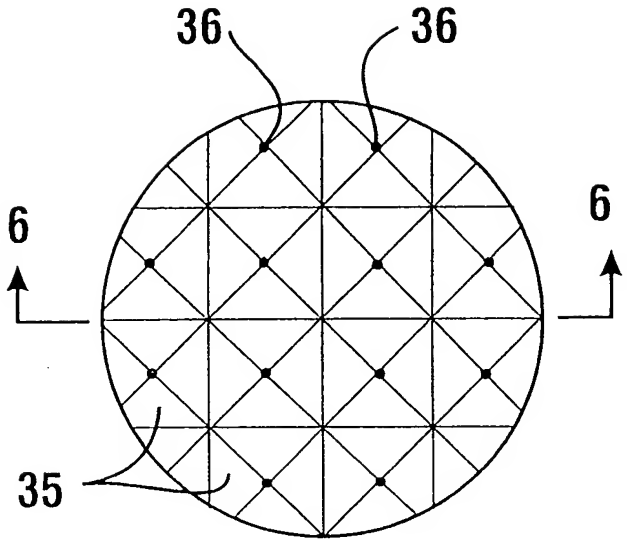

FIG. 5

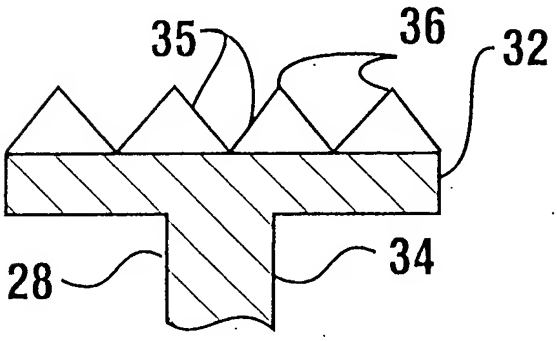

FIG. 6

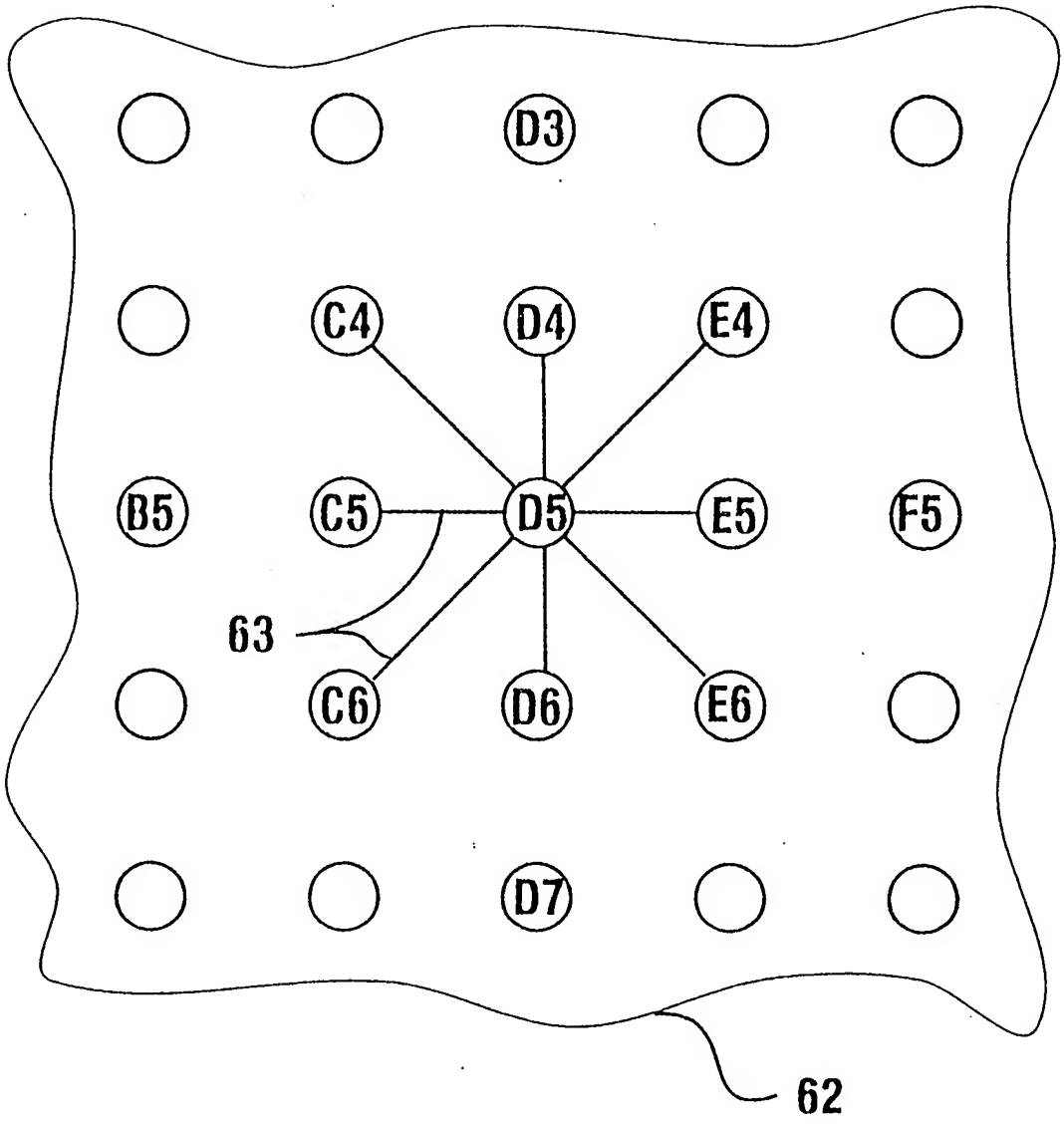

FIG. 7

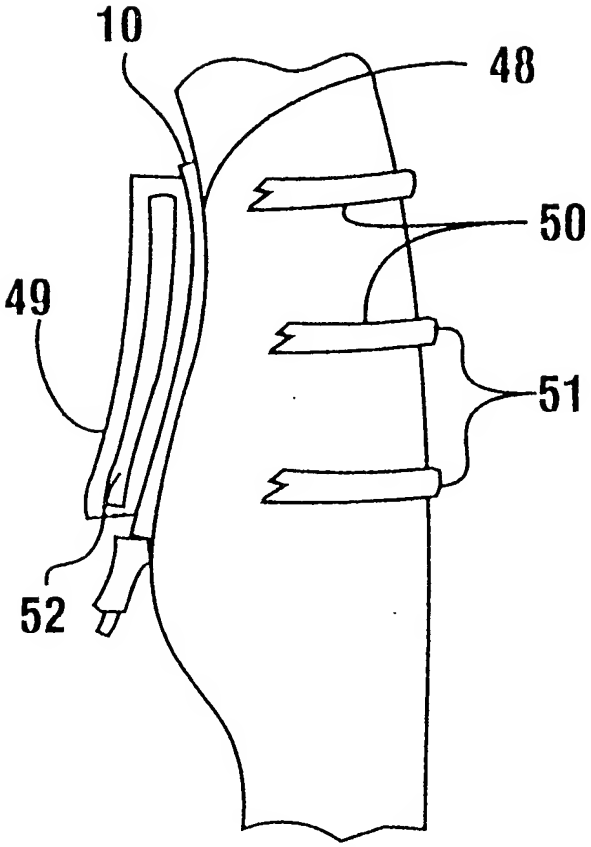

FIG. 8

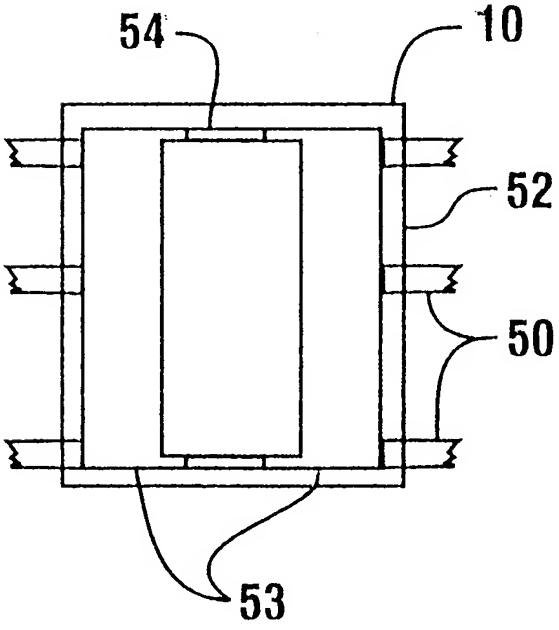

FIG. 9

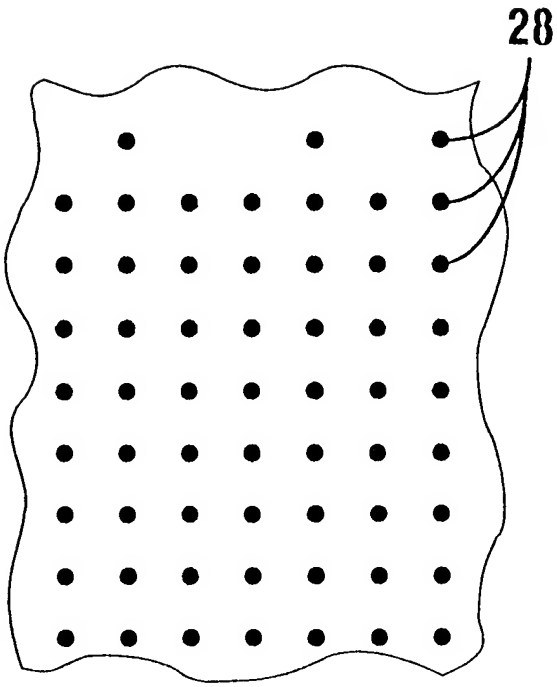

FIG. 10

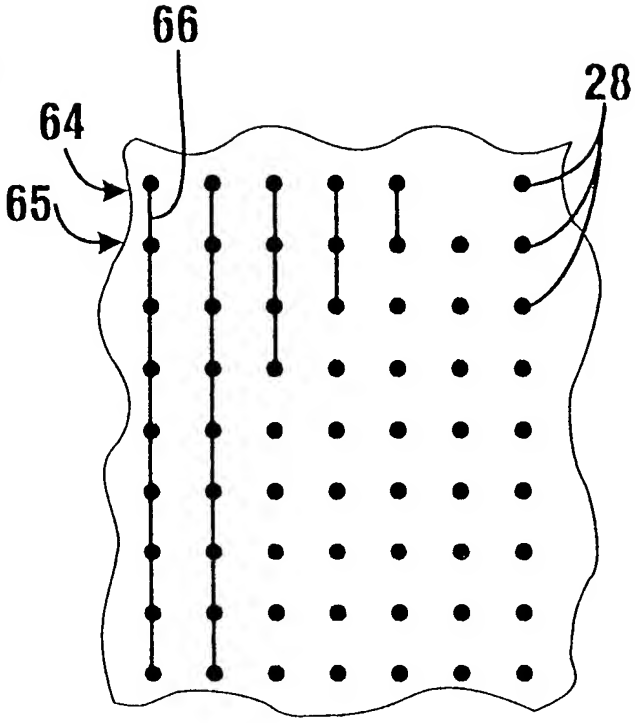

FIG. 11

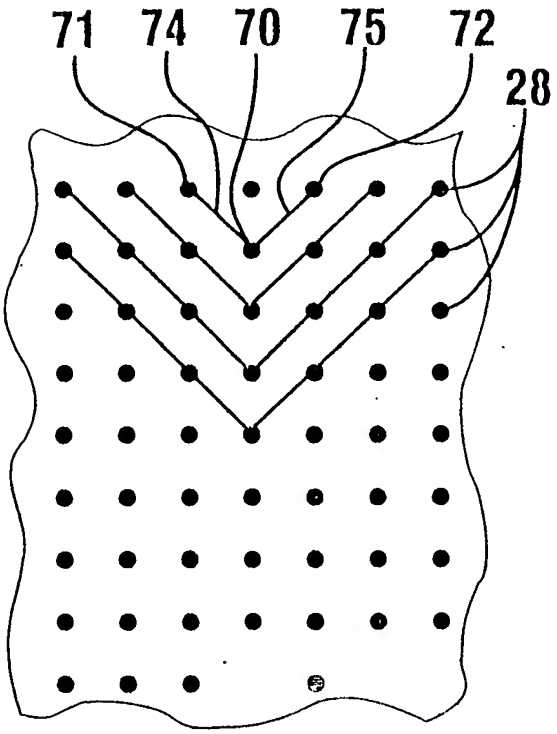

FIG. 12

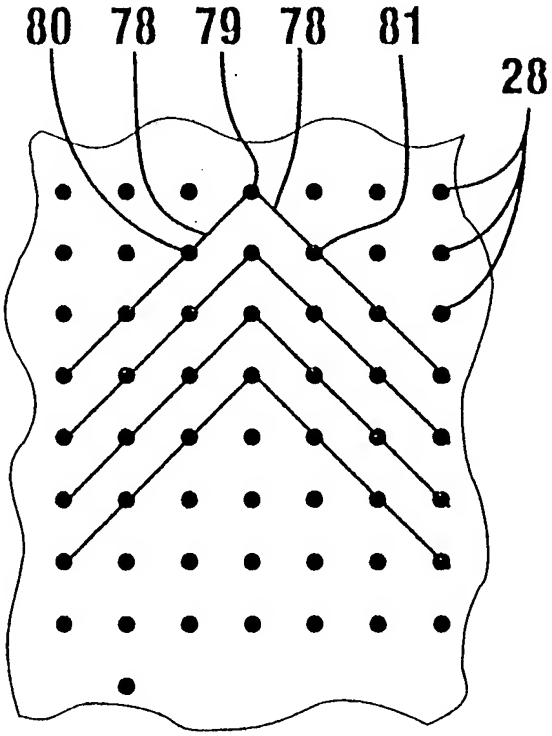

FIG. 13

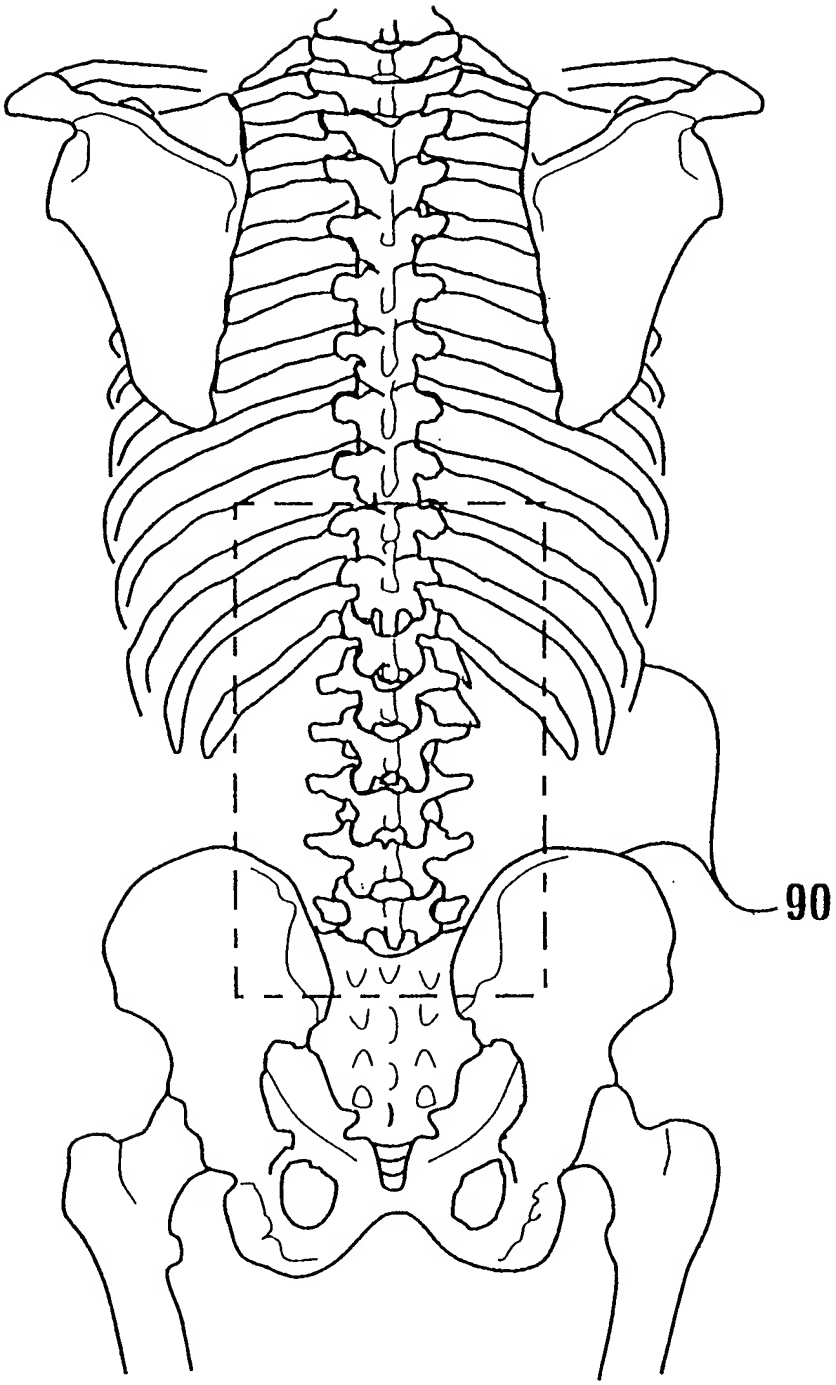

FIG. 14

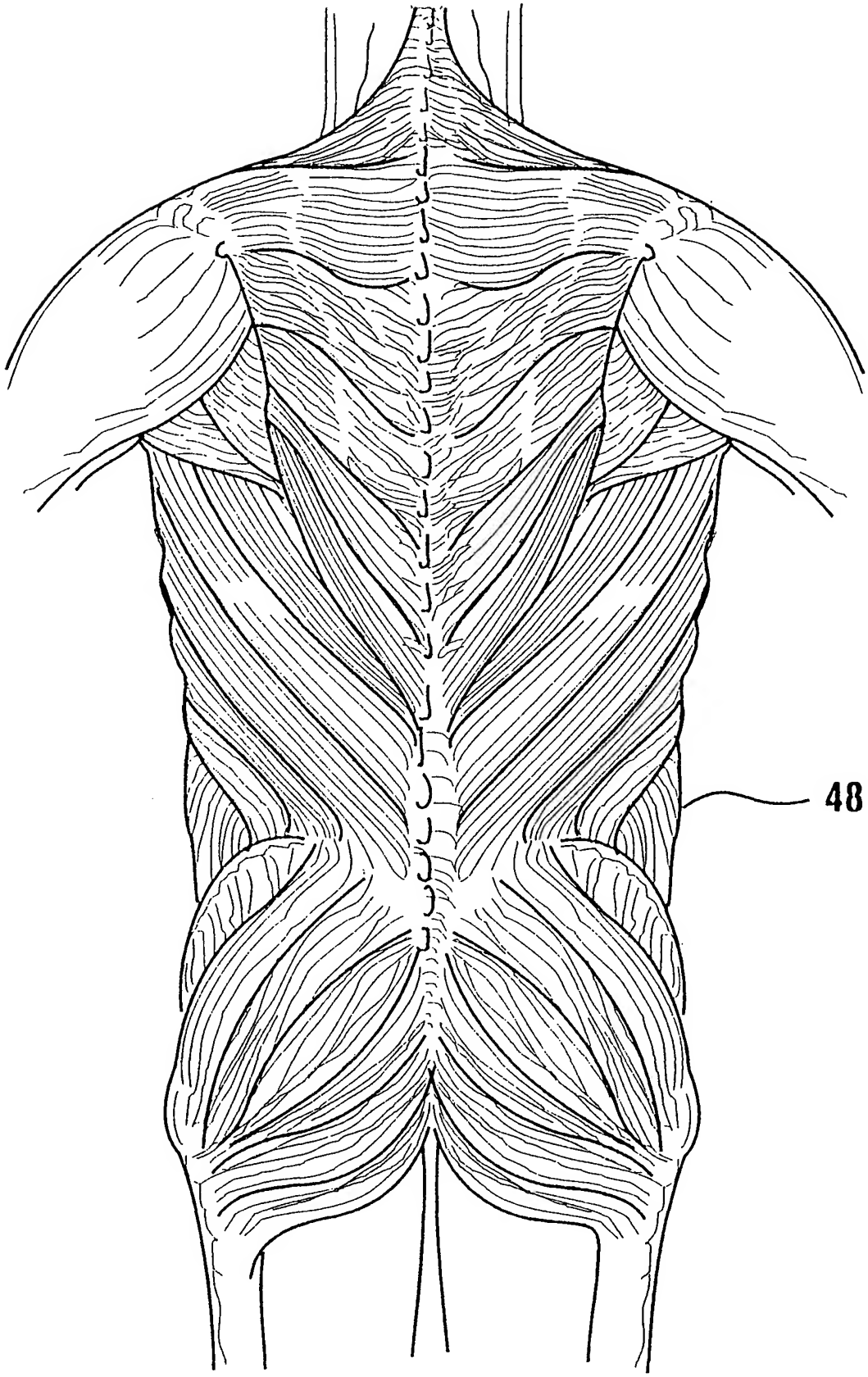

FIG. 15

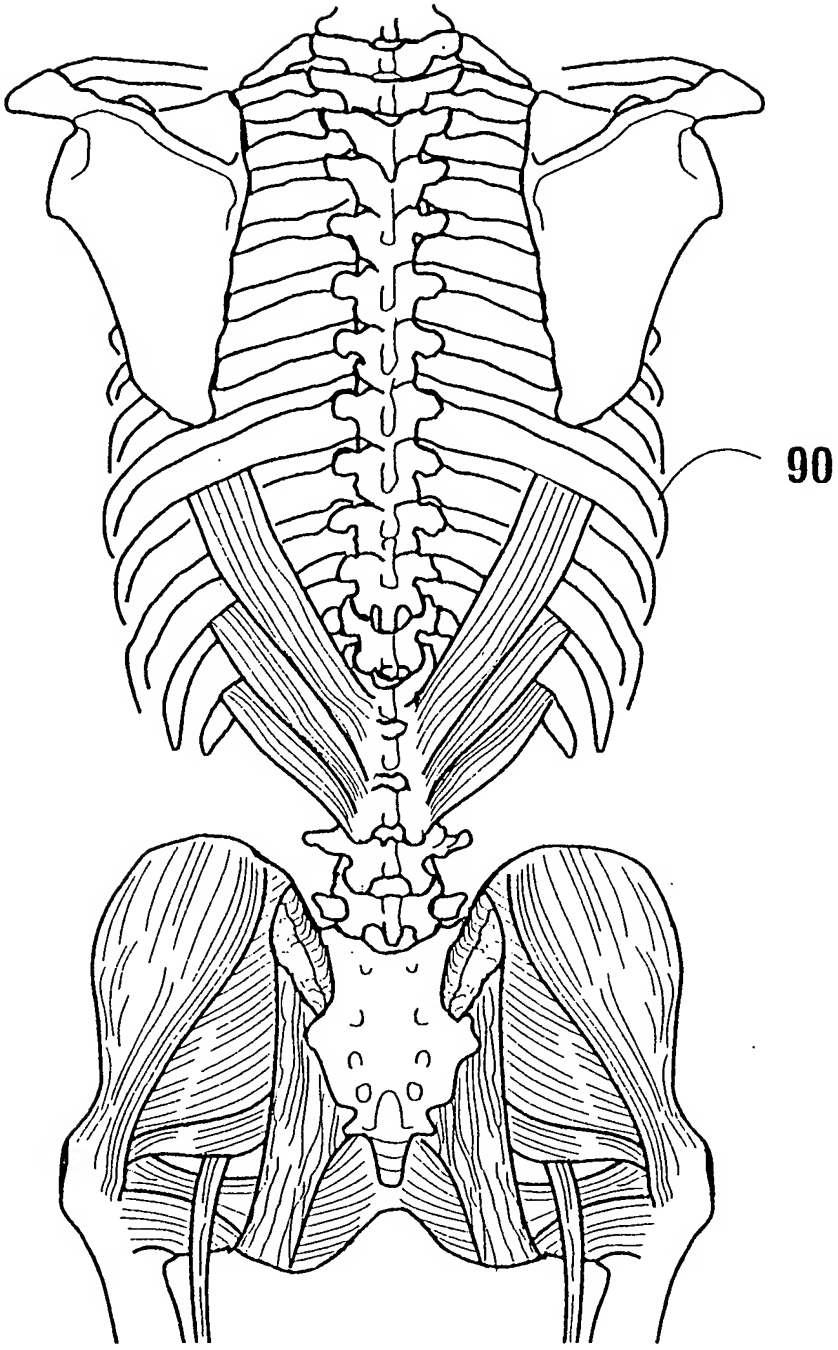

FIG. 16

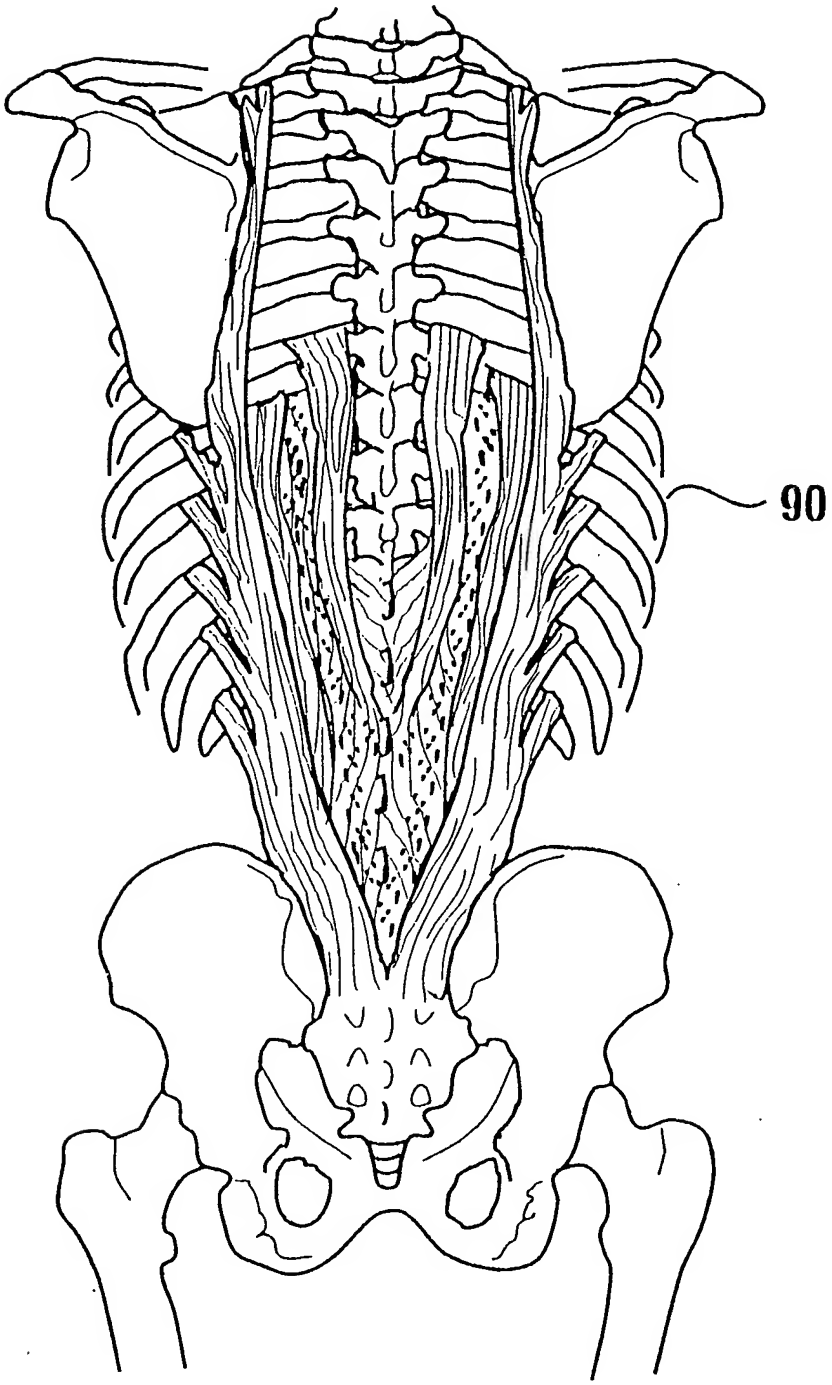

FIG. 17

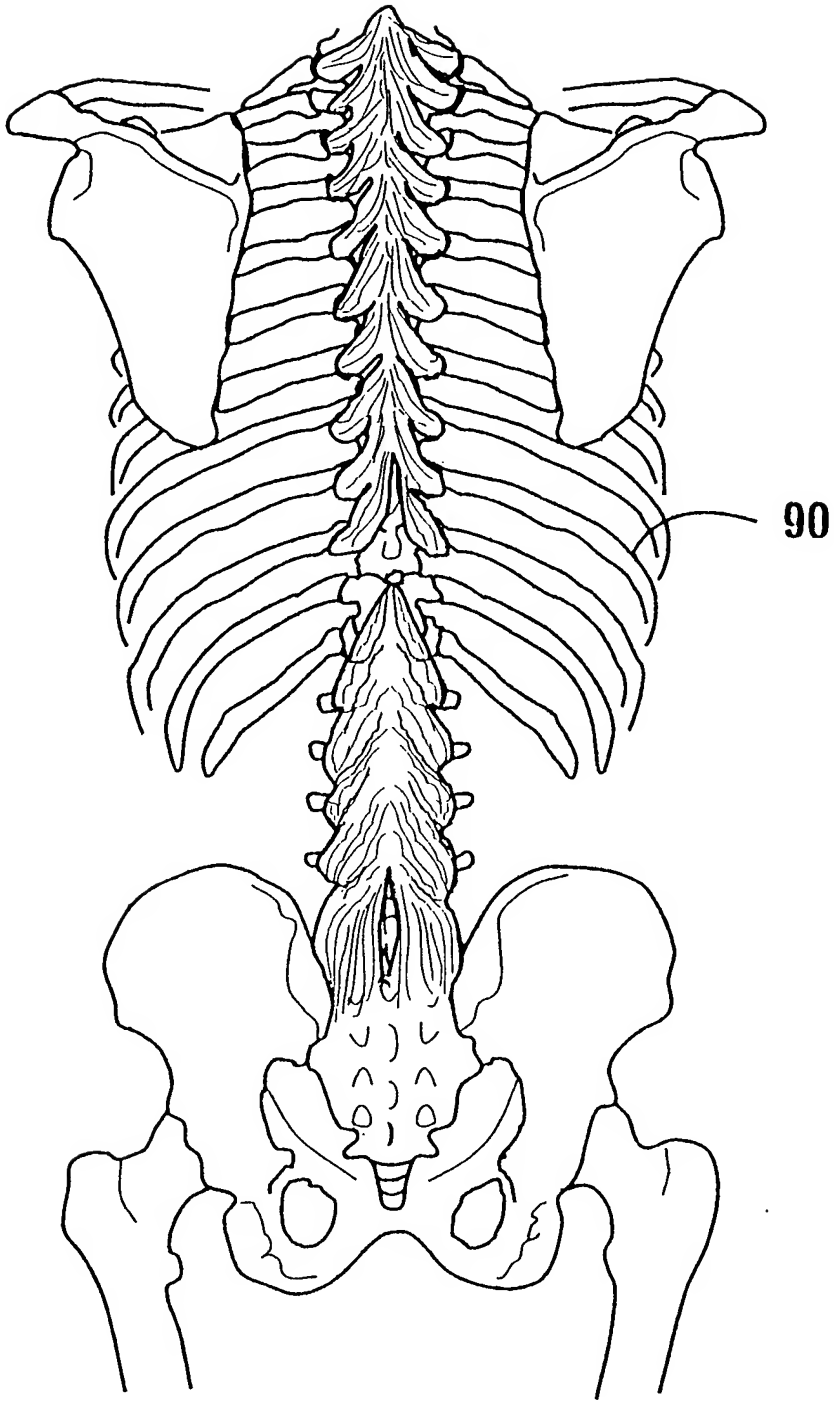

FIG. 18

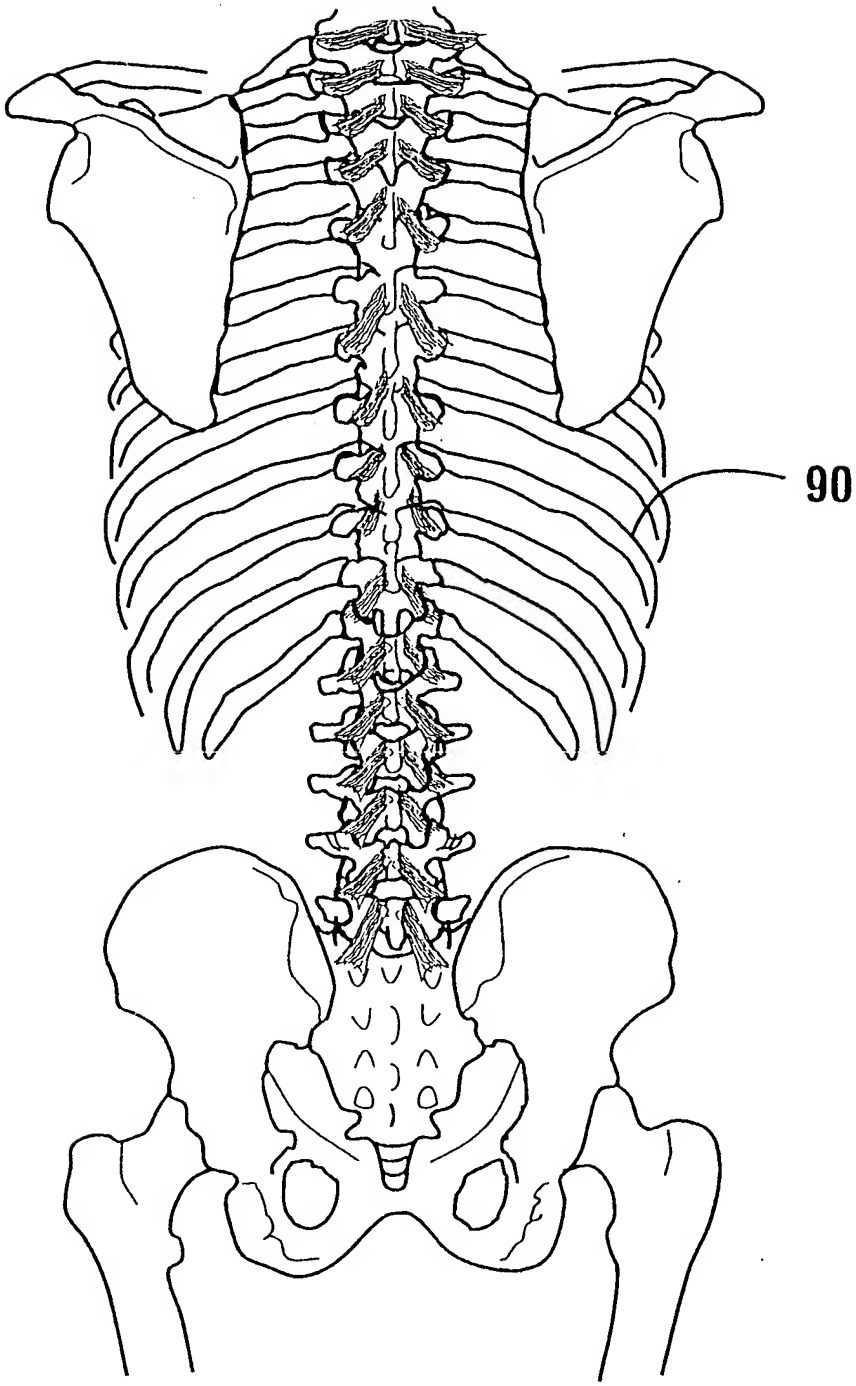

FIG. 19

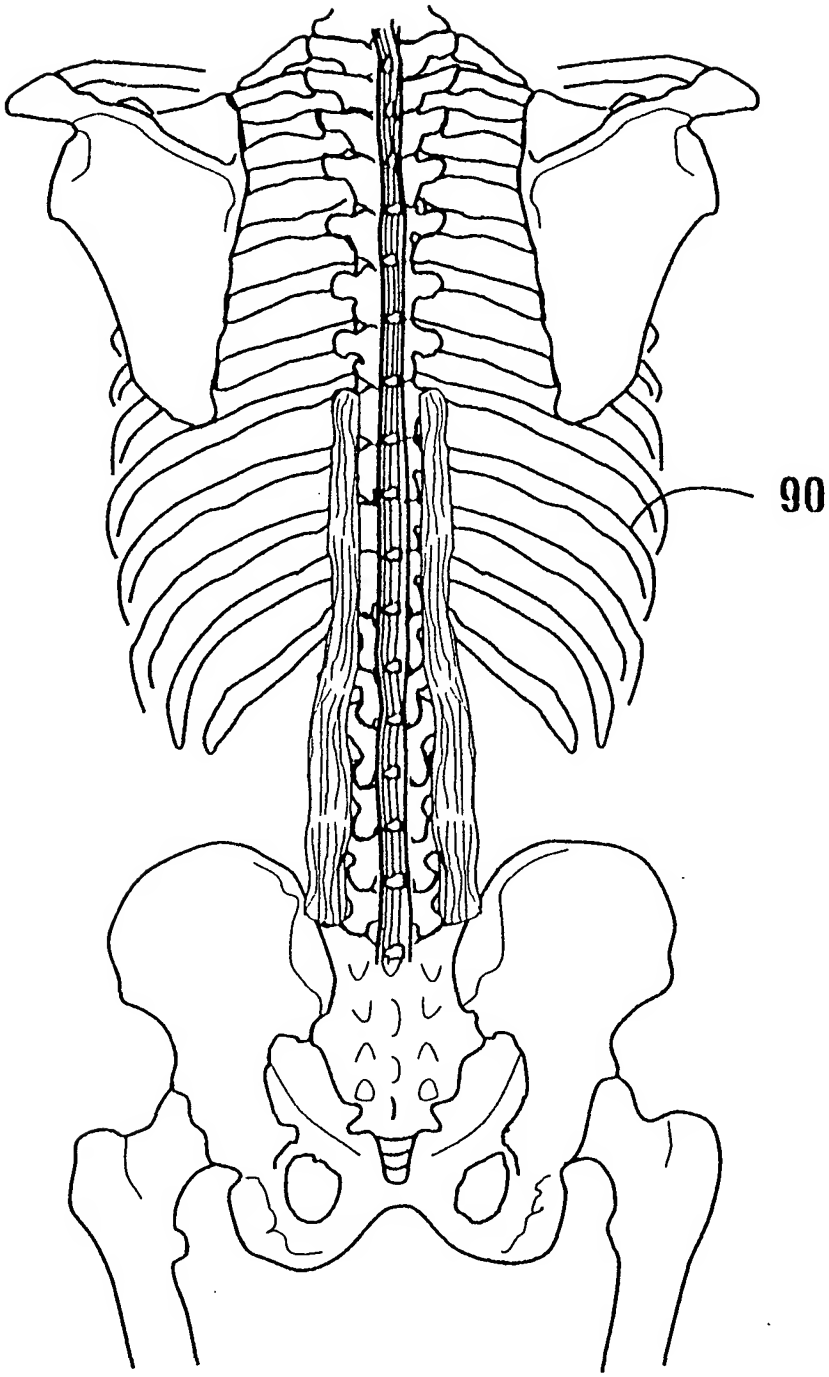

FIG. 20

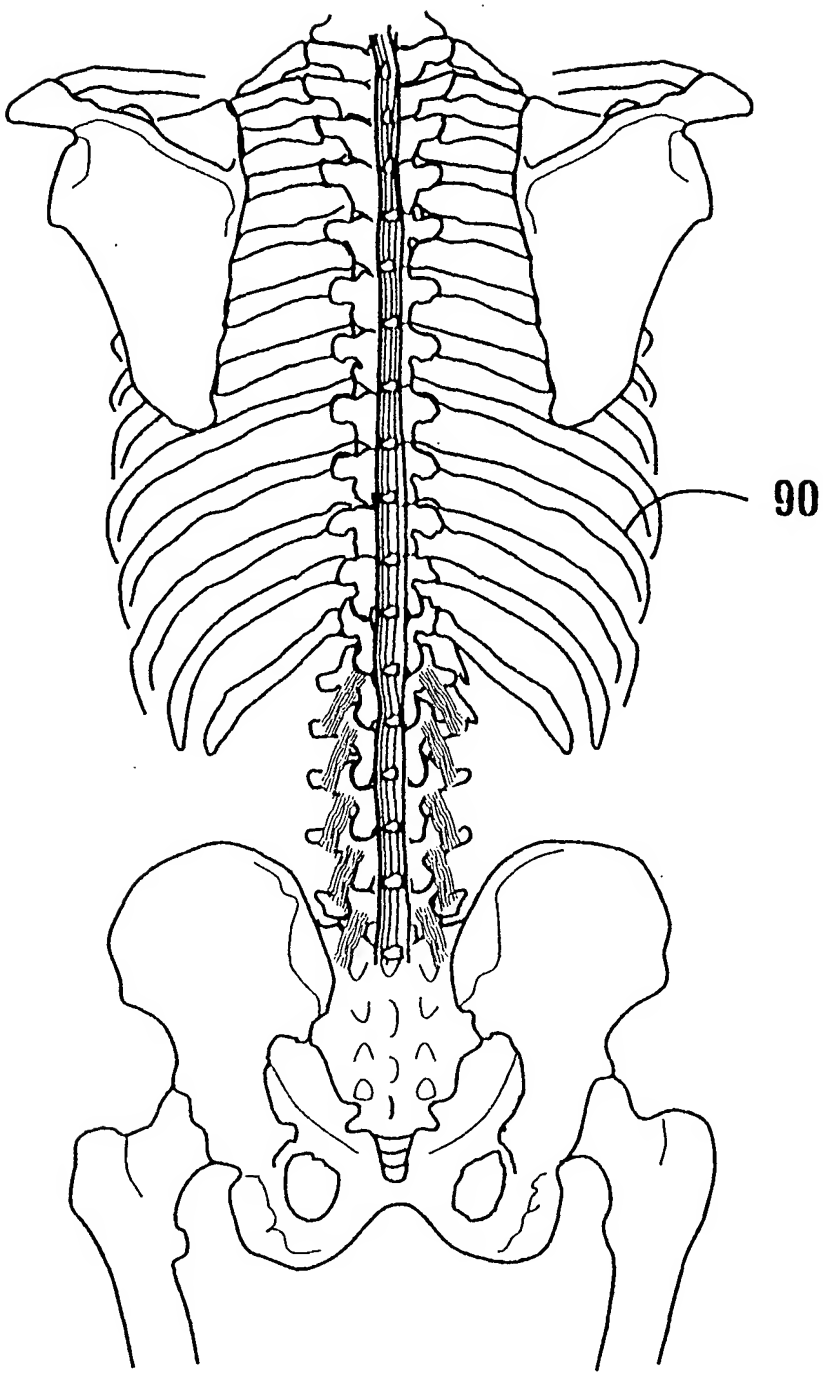

FIG. 21

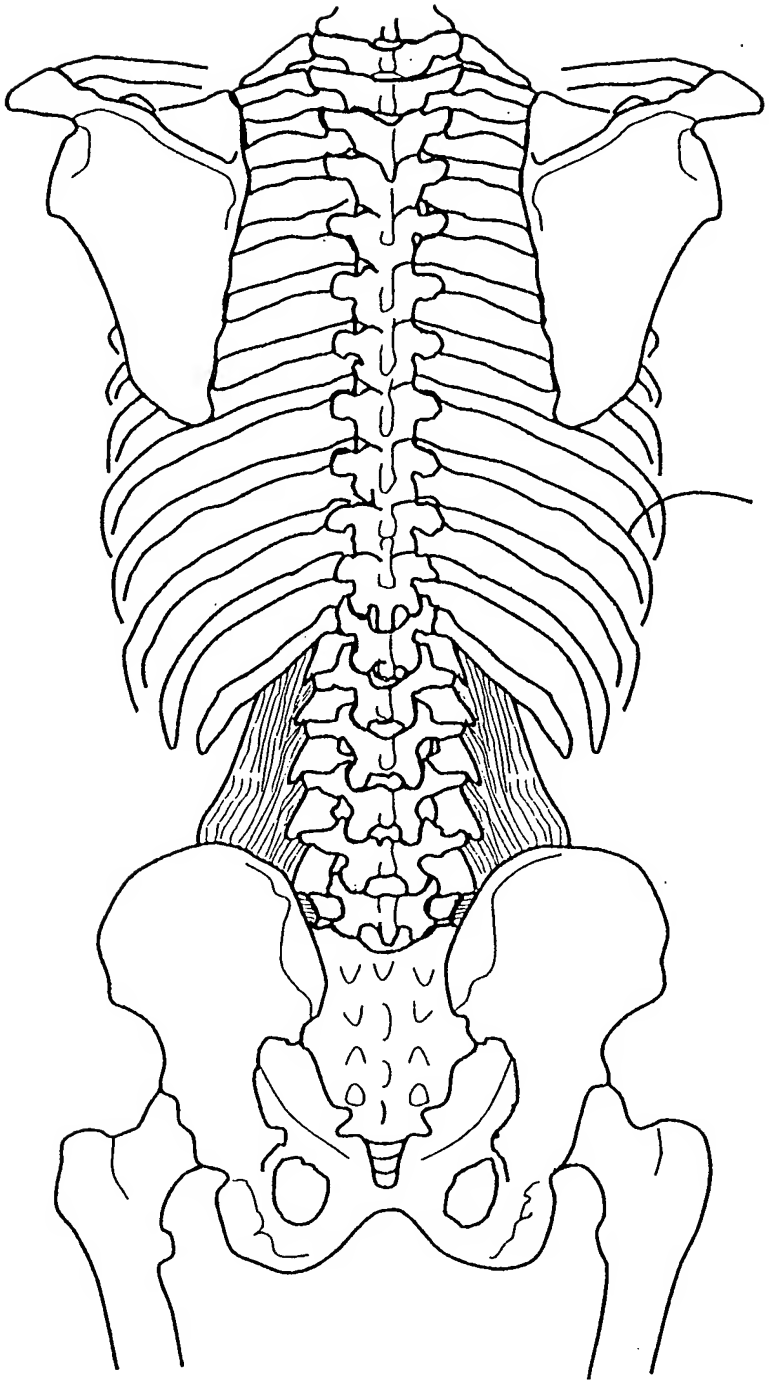

FIG. 22

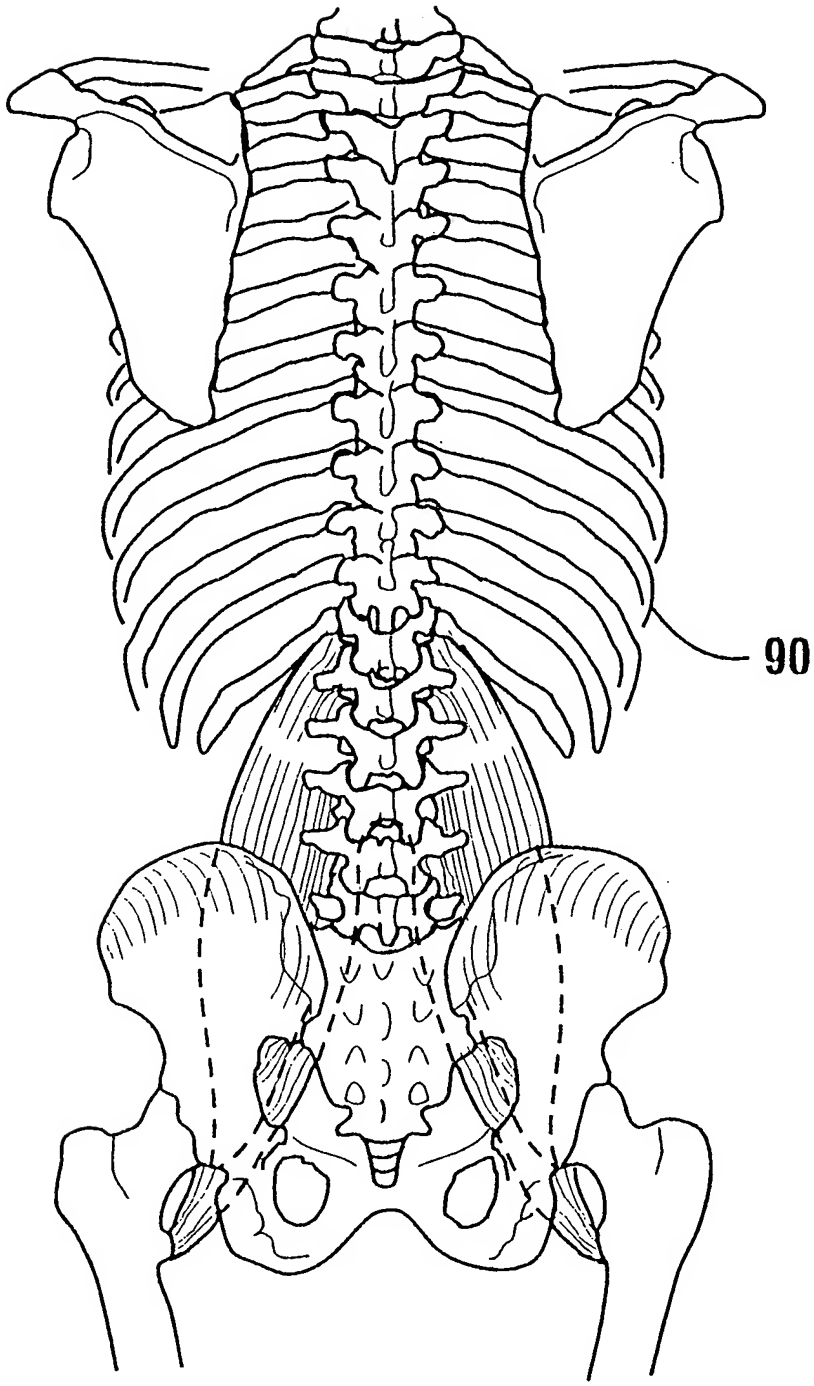

FIG. 23

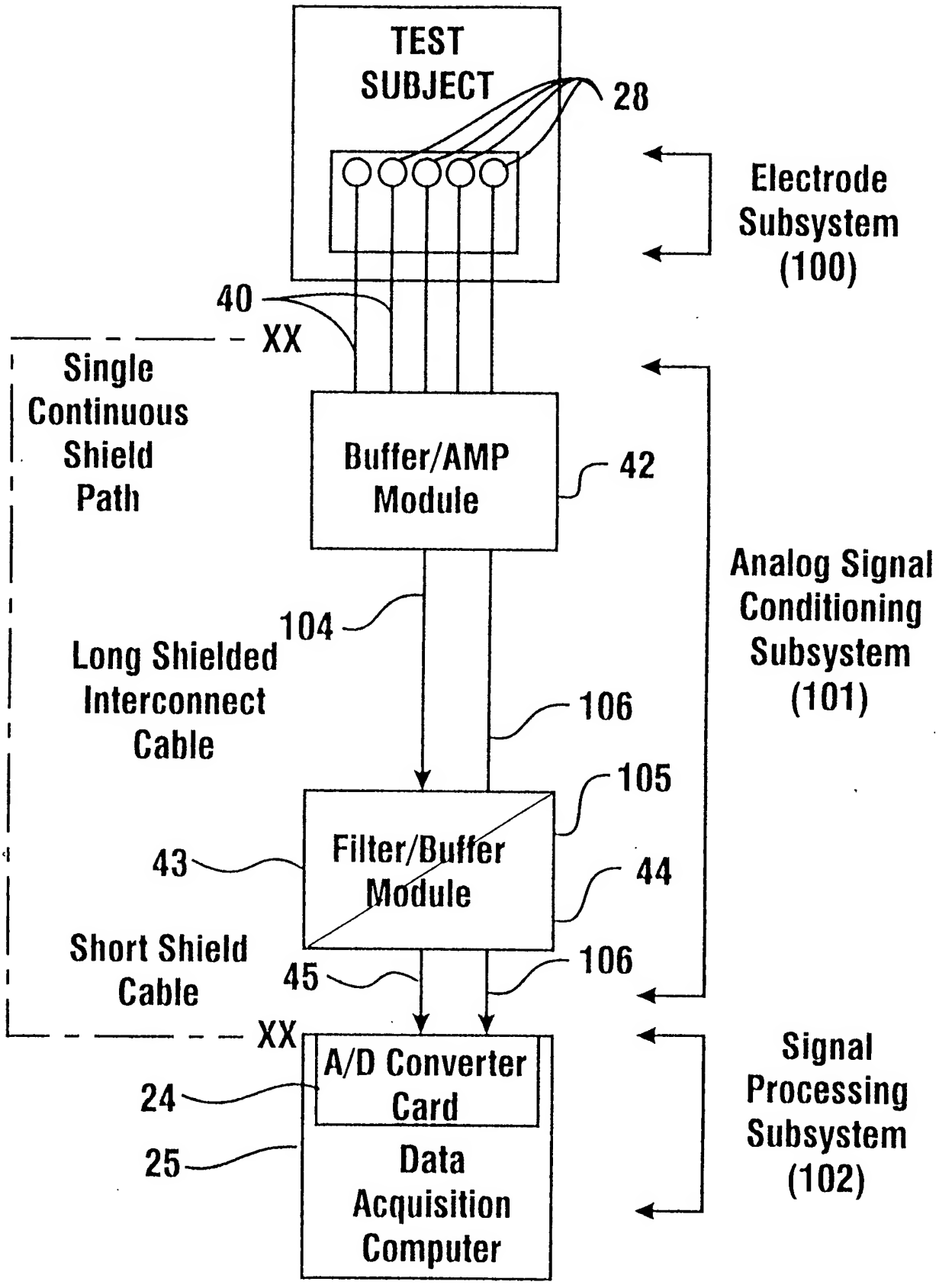
TEST SUBJECT
28
Electrode Subsystem (100)
40
XX
Single Continuous Shield Path
Buffer/AMP Module
42
Analog Signal Conditioning Subsystem (101)
104
Long Shielded Interconnect Cable
106
105
43
Filter/Buffer Module
44
Short Shield Cable
45
106
XX
A/D Converter Card
24
25
Data Acquisition Computer
Signal Processing Subsystem (102)

FIG. 24

Analog Signal Conditioning Subsystem (101)

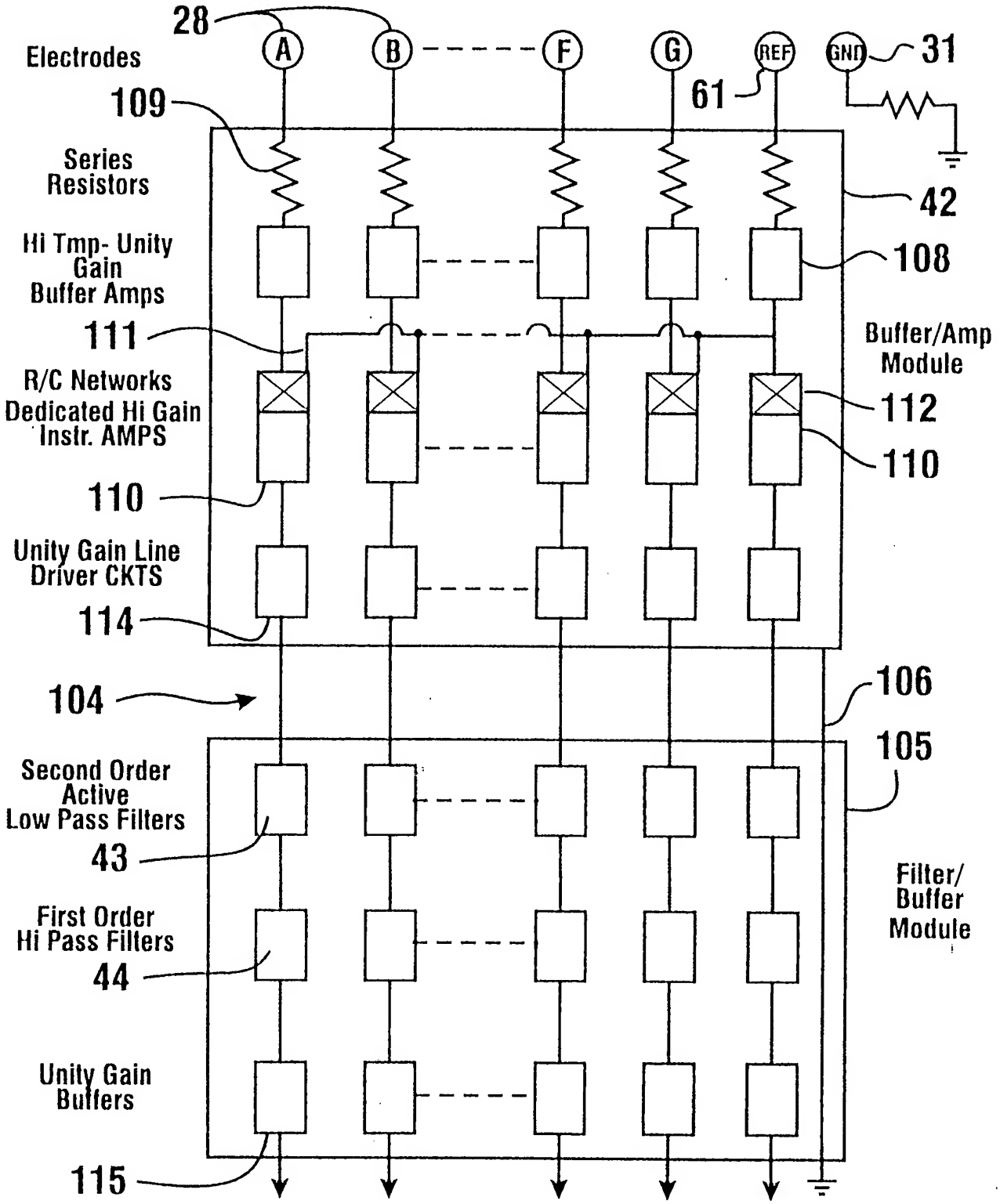

FIG. 25

Signal Processing Subsystem (102)

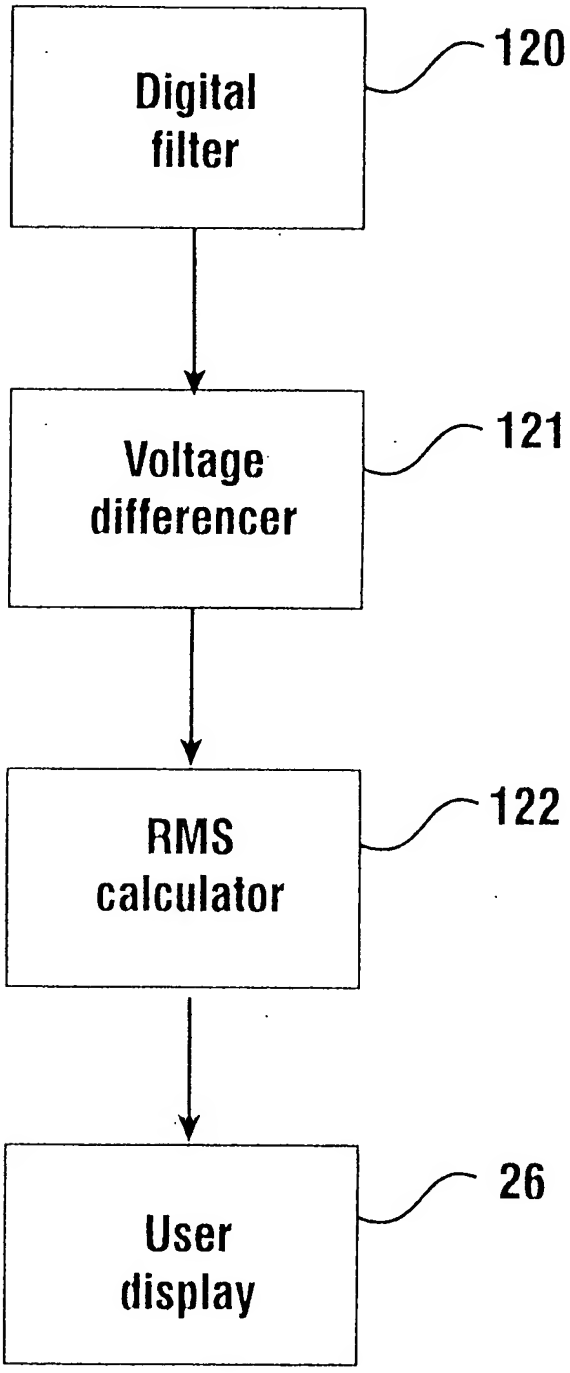

FIG. 26

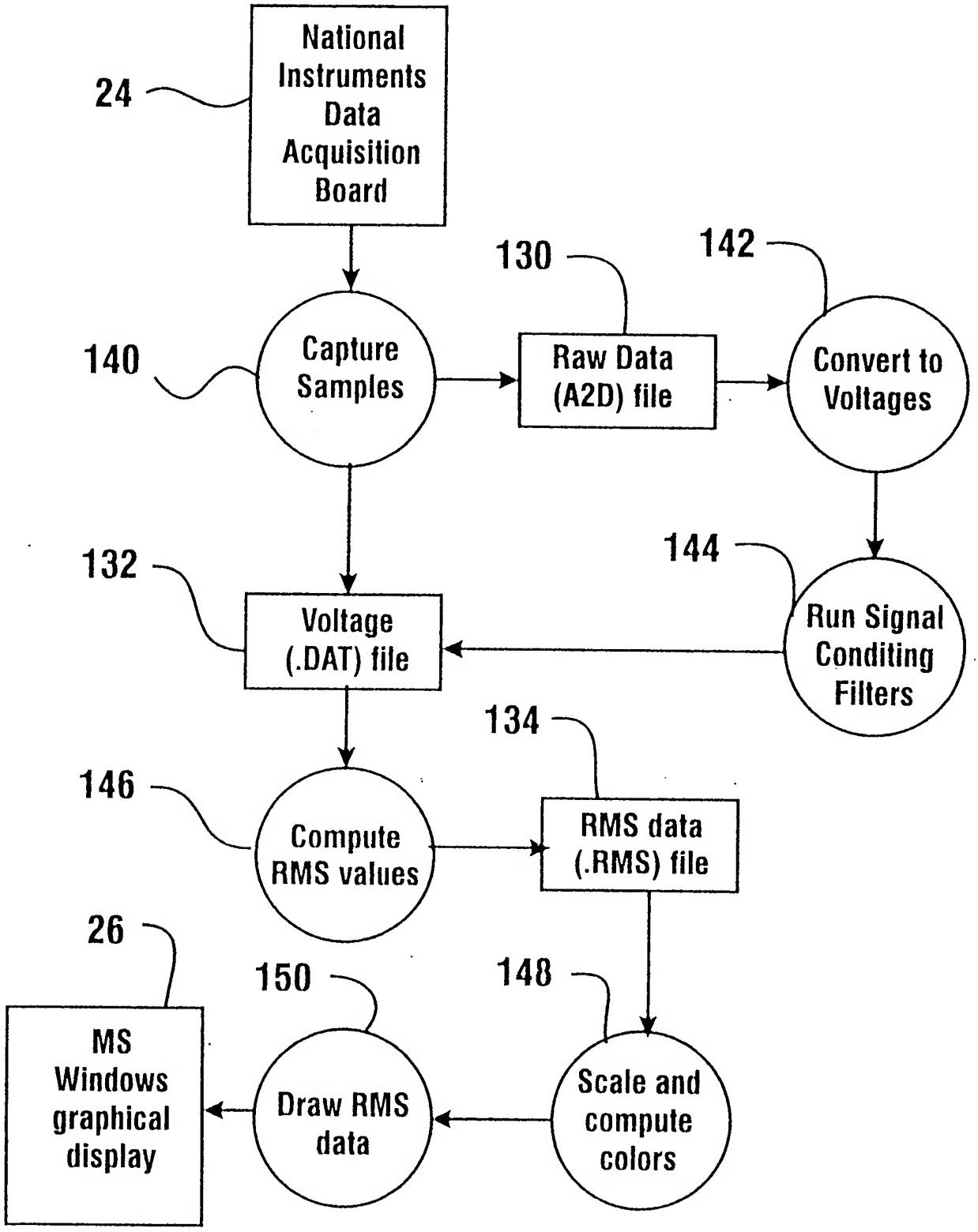
National Instruments Data Acquisition Board
24
Capture Samples
140
Raw Data (A2D) file
130
Convert to Voltages
142
Voltage (.DAT) file
132
Run Signal Conditing Filters
144
Compute RMS values
146
RMS data (.RMS) file
134
Scale and compute colors
148
Draw RMS data
150
MS Windows graphical display
26

FIG. 27

Software Program - Header Format (135)

Version Information: (152)

File version major
File version minor

Patient Information: (154)

Patient name
Patient initials
Age
Weight
Sex
Height (Feet and Inches)
Birth date
Current date
Comments

Pad Information: (155)

Model name
Vertical number of electrodes
Horizontal number of electrodes
Vertical electrode spacing (cm)
Horizontal electrode spacing (cm)

Calibration Information: (156)

Spinous process T-10x coordinate (pixels)
Spinous process T-10y coordinate (pixels)
Left PSIS x coordinate (pixels)
Left PSIS y coordinate (pixels)
Right PSIS x coordinate (pixels)
Right PSIS y coordinate (pixels)

Data Acquisition Settings: (157)

Number of channels scanned
Pre-amplifier gain
Analog digital board gain
Scan rate (seconds)
Scan period (seconds)
Pre-scan period (milliseconds)

Display Settings: (158)

Minimum voltage to display (display software will show voltages below this value as saturated)
Maximum voltage to display (display software will show voltages above this value as saturated)

FIG. 28

Software Program - File List

Analog-to-Digital (*A2D) Files (130)

A2D files contain the actual analog-to-digital values collected from the National Instruments hardware during a test. The files contain the header described above and the Analog-to-digital values. The structure of an A/D scan is:

<Scan 1, channel 1>< Scan 1, channel 1, channel 3>...
<Scan 2, channel 1>< Scan 2, channel 2, channel 3>...
Etc...

Each scan is stored in a two byte word in little endian format.

Voltage (*.DAT) Files (132)

DAT files contain the voltage data from a test, after it has been converted from A/D values to voltages and signal conditioning filters have been applied. The files contain the header described above followed by the voltage values. The Format is:

<Scan 1, channel 1><Scan 1, channel 2><Scan 1, channel 3>...
<Scan 2, channel 1><Scan 2, channel 2><Scan 2, channel 3>...
etc...

Each scan is stored as an IEEE double floating point value.

RMS (*.RMS) Files (134)

RMS files contain the RMS values of the differences between the voltage waveforms of adjacent electrodes. During display of an RMS file, the values can then be mapped to colors, and displayed as colored line segments. The files contain the header described above by the RMS information.

The RMS voltage differences is calculated for each pair of adjacent electrodes. The row and column position of each of the two electrodes are also stored.

First electrodes' row number
First electrodes' column number
Second electrodes' row number
Second electrodes' column number
RMS values

The following information about the RMS values is also stored:

Minimum RMS value in scan
Maximum RMS value in scan
Total number of adjacent electrodes pairs

FIG. 29

Software Program Source File Structure (160)

Document/view and visual interface: (161)

PDIMFC.CPP	Main initialization of application, display of splash screen and about dialog box.
MAINFORM.CPP	Message handlers for main window, menu and toolbar commands
CHILDFORM.CPP	Message handlers for child windows (the views).
PDNIFCDOC.CPP	Document: handles the commands to create new RMS files open existing ones.
GRAPH.CPP	Document: reads RMS files and calculates the colors to display for RMS values.
PDINFCVIEW.CPP	View: Displays and handles user interface controls for the RMS graph display.

Dialog popups: (162)

DIALOGPATIENT. CPP	Dialog for entering patient information.
DIALOGCALIBRATE. CCP	Dialog for entering calibration information.
DIALOGDATAAQ.CPP	Dialog that allows user to launch acquisitions of data and view acquisition parameters (Scan rate, pre-amplifier gain, etc)
DIALOG SETTINGS. CPP	Dialog that allows editing of data acquisition and display parameters.
SPLASHDIALOG. CPP	Popup display of software titles and spiffy back picture.

Data acquisition, filtering, and calculation: (163)

DAQHW.CPP	Interface to National Instruments software. Sets A/D board parameters and starts data acquisition
READATOD.CPP	Routines for calculating RMS values, converting A/D values to voltage, and signal conditioning
FILTER.CPP	Filtering algorithms including high pass, low pass, and band pass with over-sampling

Reading and writing header information and data: (164)

PATIENT.CPP	Read/Write patient information.
CALIBRATE.CPP	Read/Write calibrate information.
SETTING.CPP	Read/Write settings information.
PAD.CPP	Read/Write pad information.
DATA.CPP	Read/Writa A/D scan.

Utilities: (165)

FILELIST.CPP	Routines for gathering unique descriptive file names and data files.
SORT.CPP	Routine for preforming heap sort.
COMPARE. CPP	Routine passed to sort function that handles comparison.
STDAFX.CPP	Includes and other preprocessor definitions.

Bitmaps, icons, resource files: (166)

LEVEL1A.BMP,	LEVEL5B.BMP,	
LEVEL1B.BMP,	LEVEL6.BMP,	
LEVEL2.BMP,	LEVEL7.BMP	
LEVEL3.BMP,	LEVEL8.BMP	Pictures of backs for use in RMS display.
LEVEL4.BMP,		
LEVEL5A,BMP,	BITMAP1.BMP	Pad displayed in calibration dialog.
	SPLASH1A.BMP	Splash screen.
	TOOLBAR.BMP	Toolbar used at top of main window.

FIG. 30

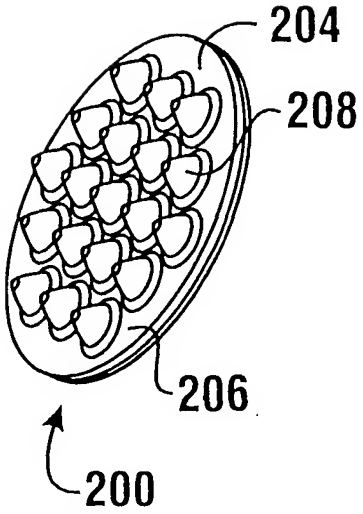

FIG. 31

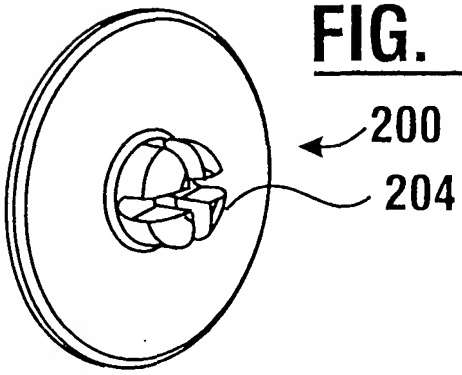

FIG. 32

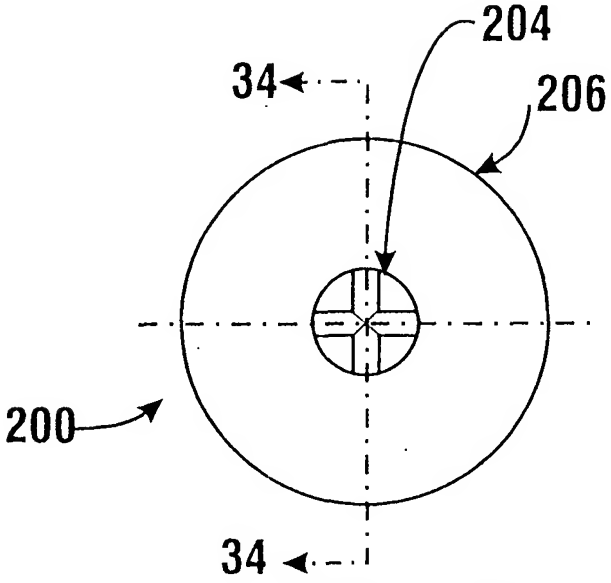

FIG. 33

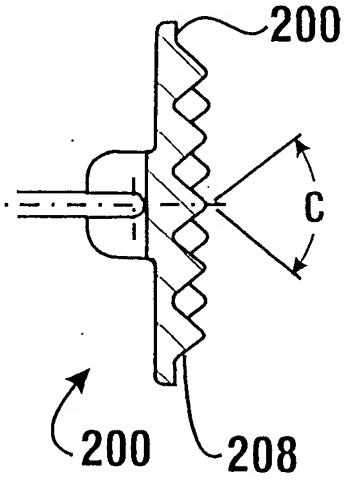

FIG. 34

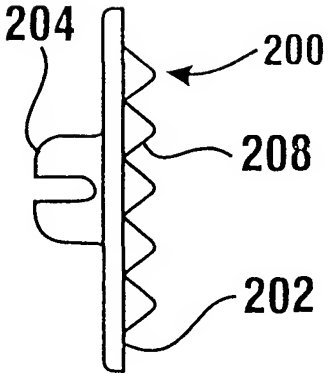

FIG. 35

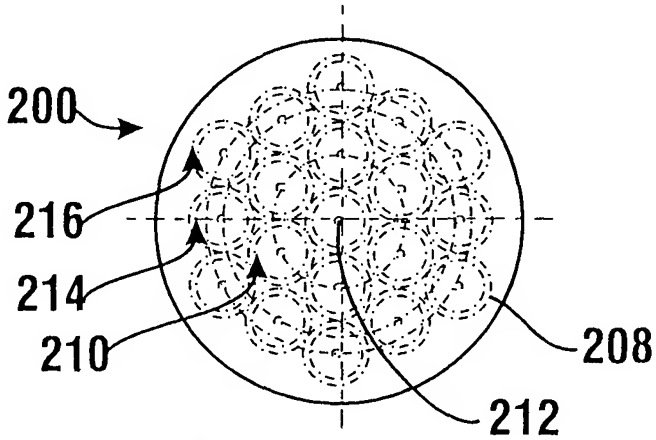

FIG. 36

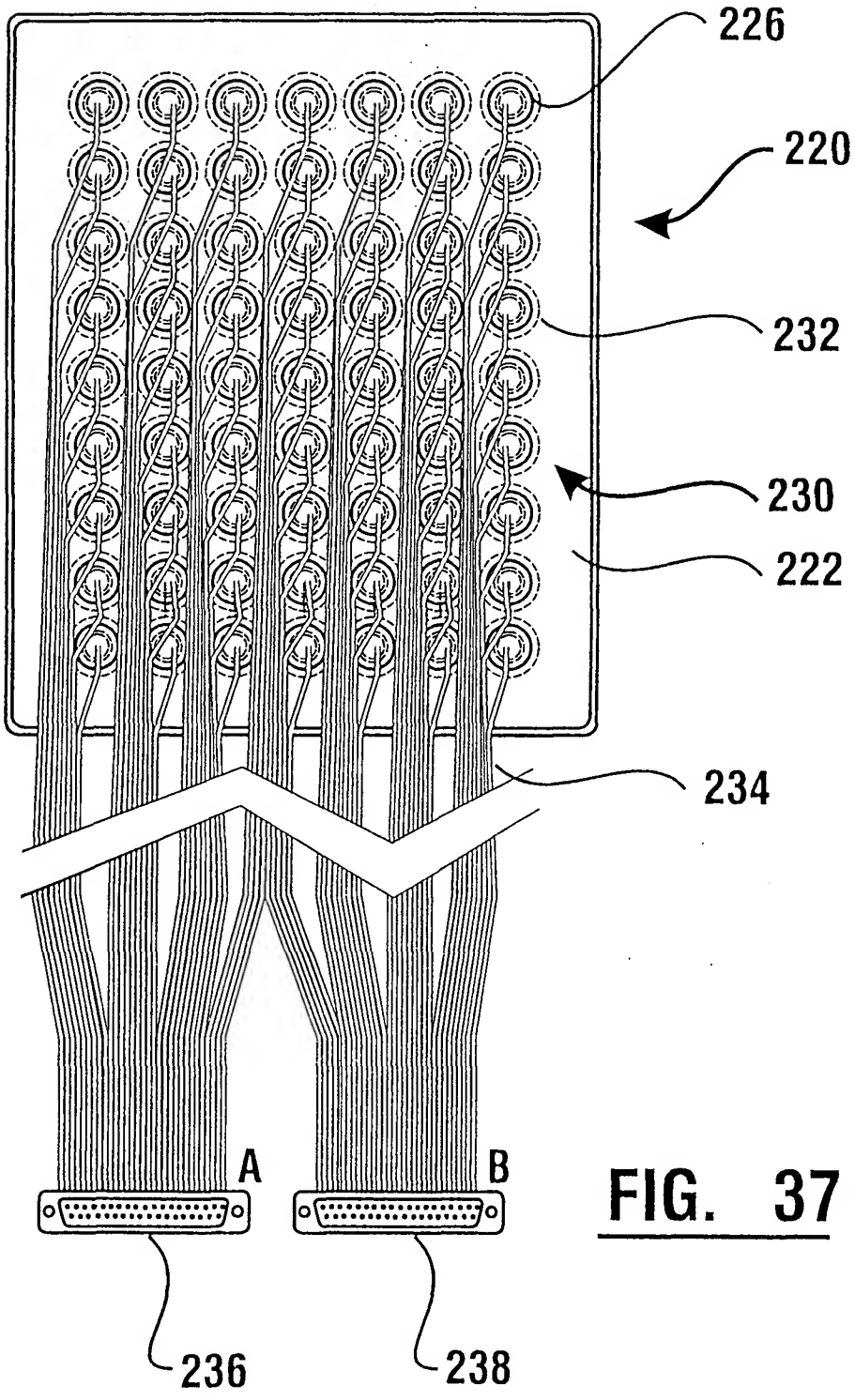

FIG. 37

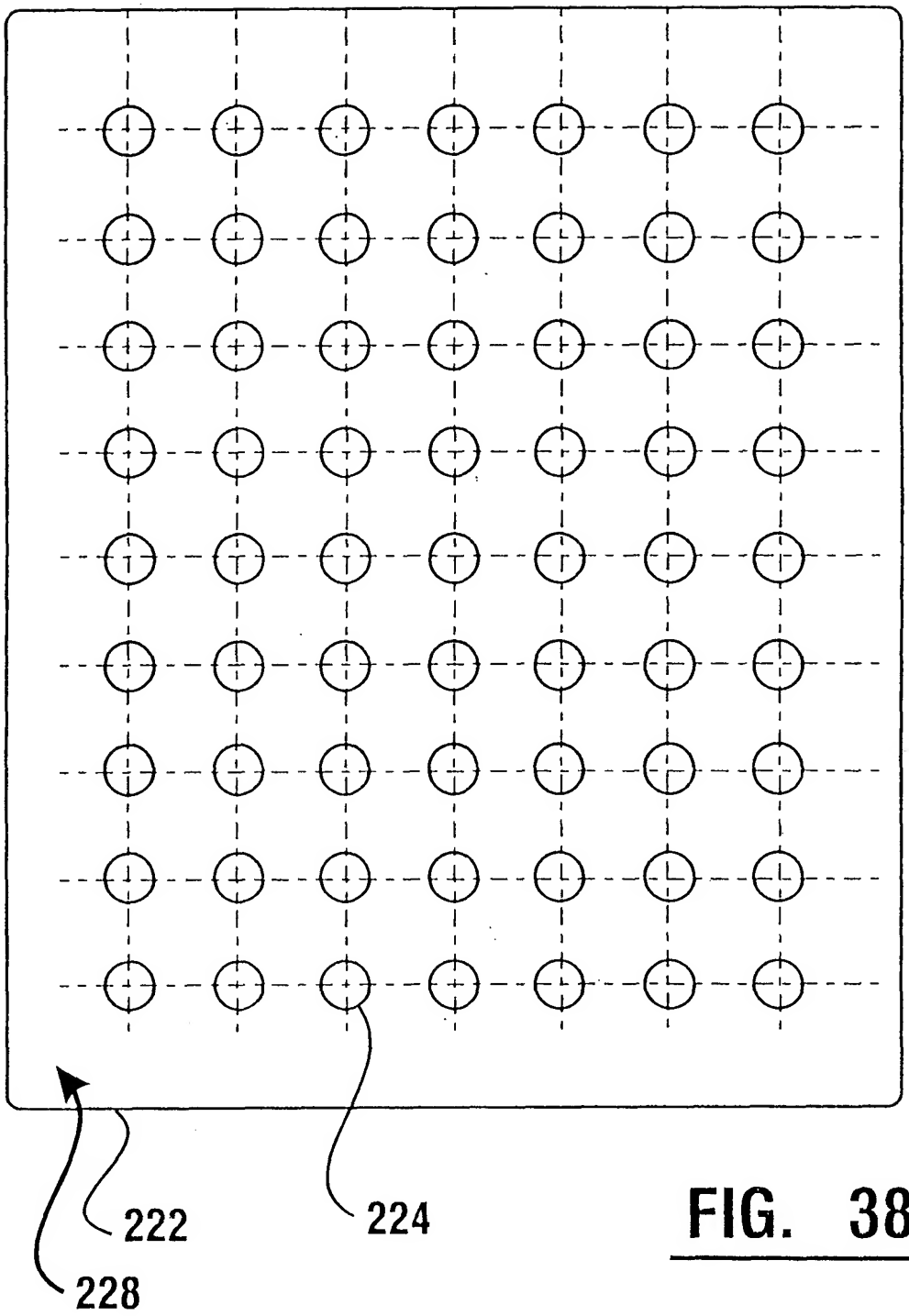

FIG. 38

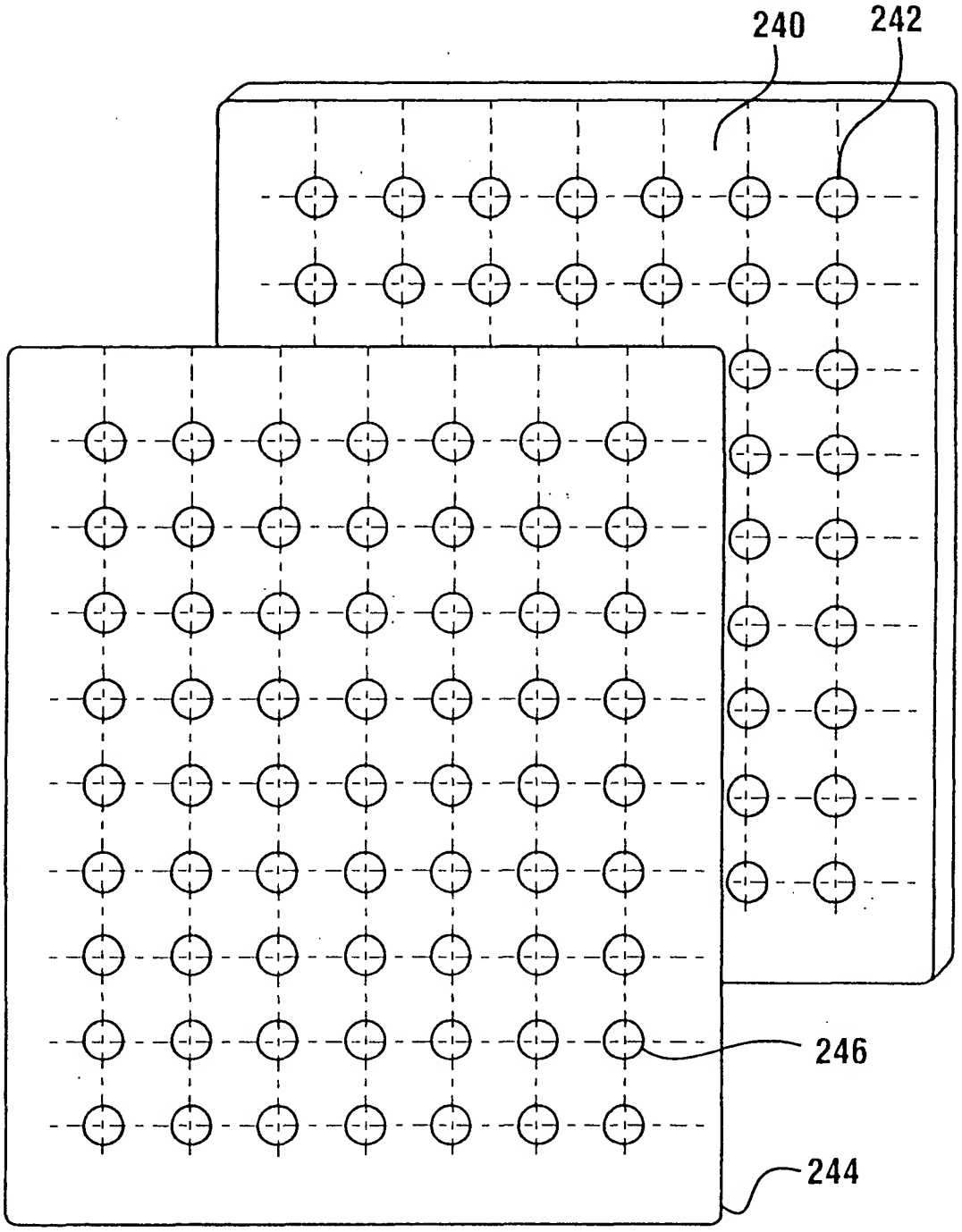

FIG. 39

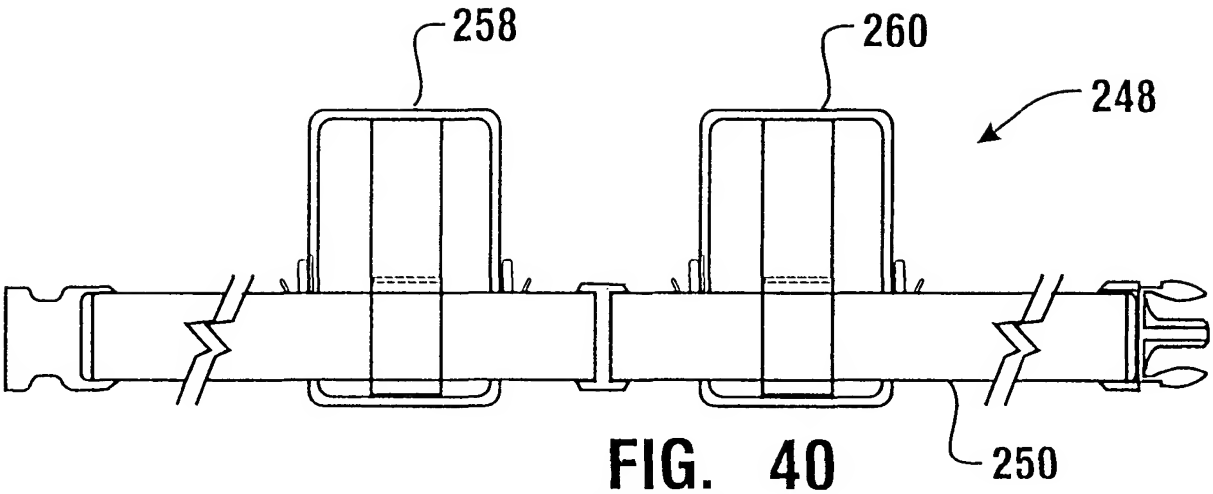

FIG. 40

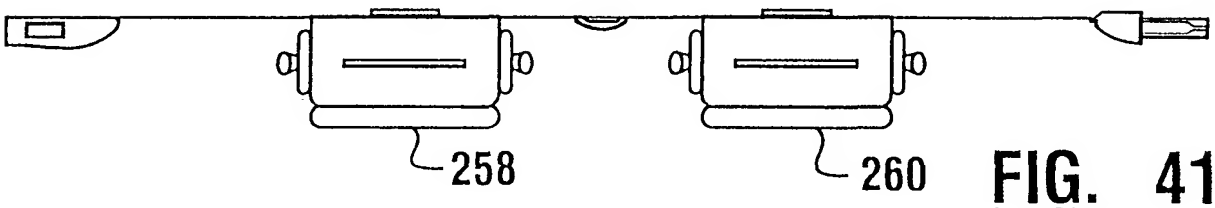

FIG. 41

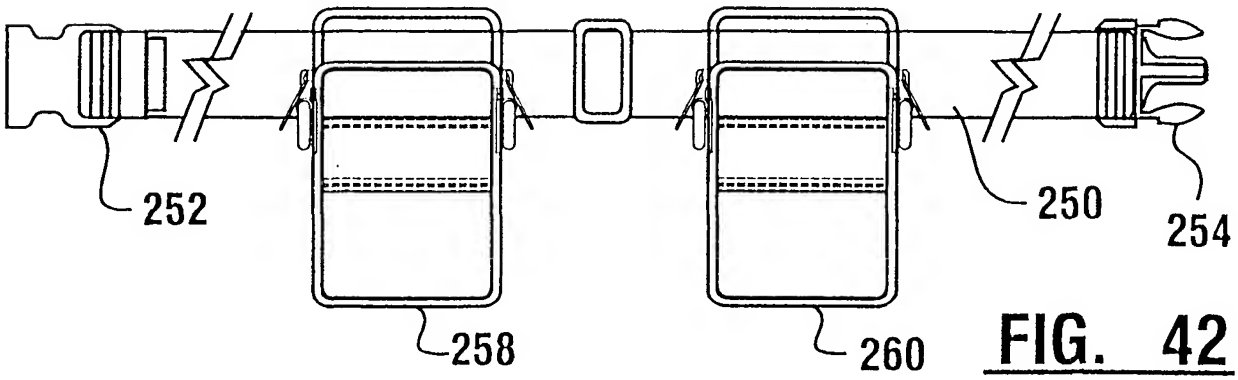

FIG. 42

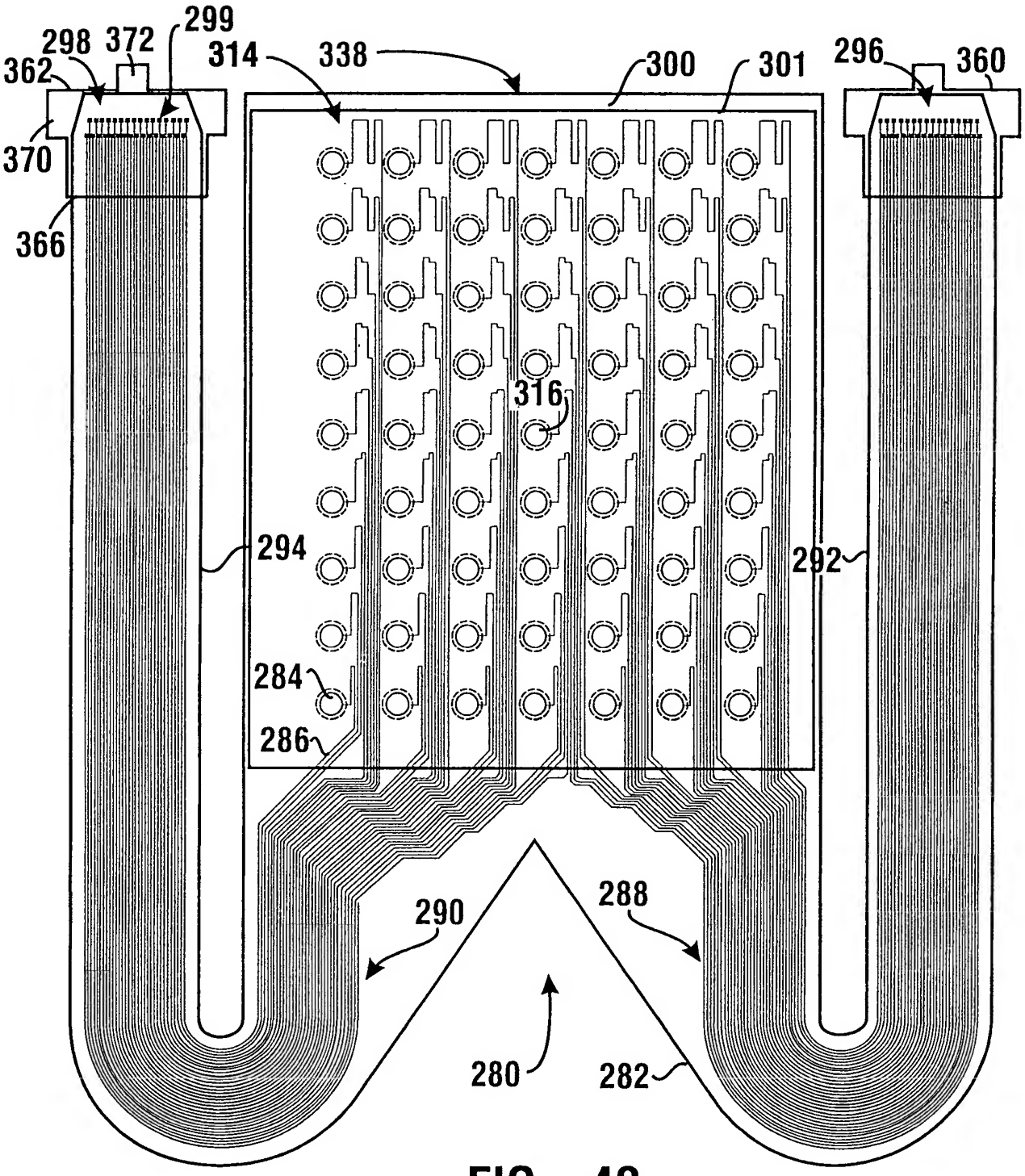
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FIG. 43

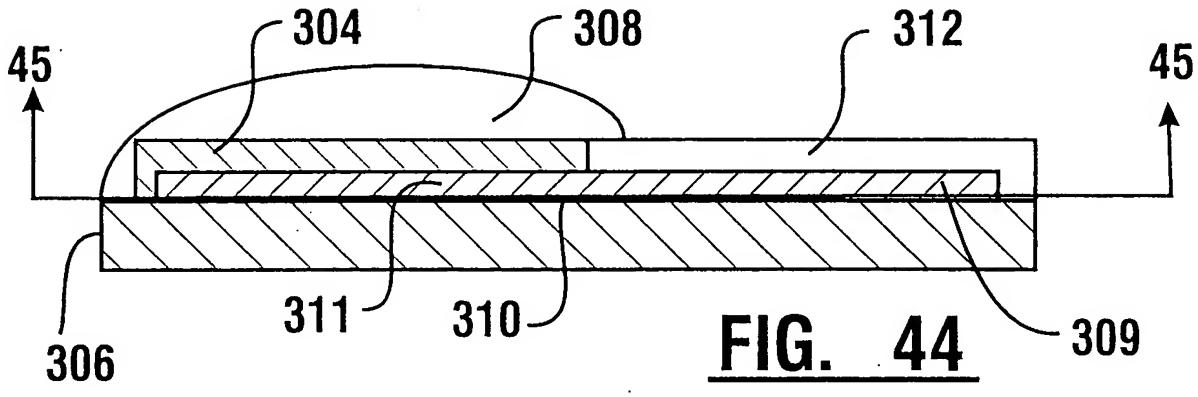

FIG. 44

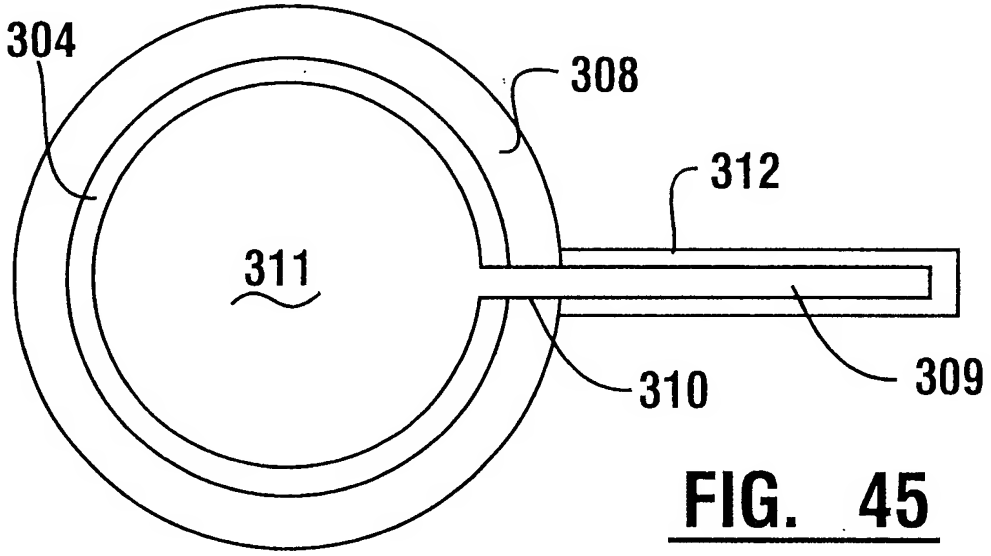

FIG. 45

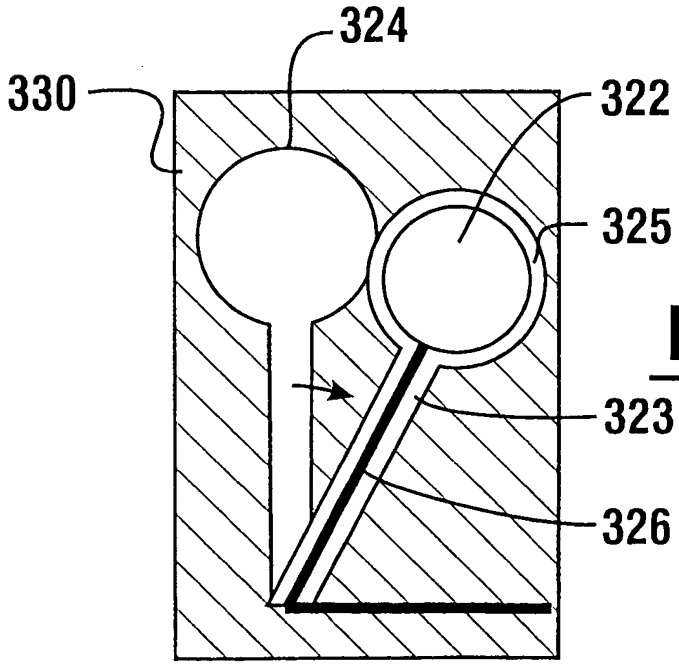

FIG. 47

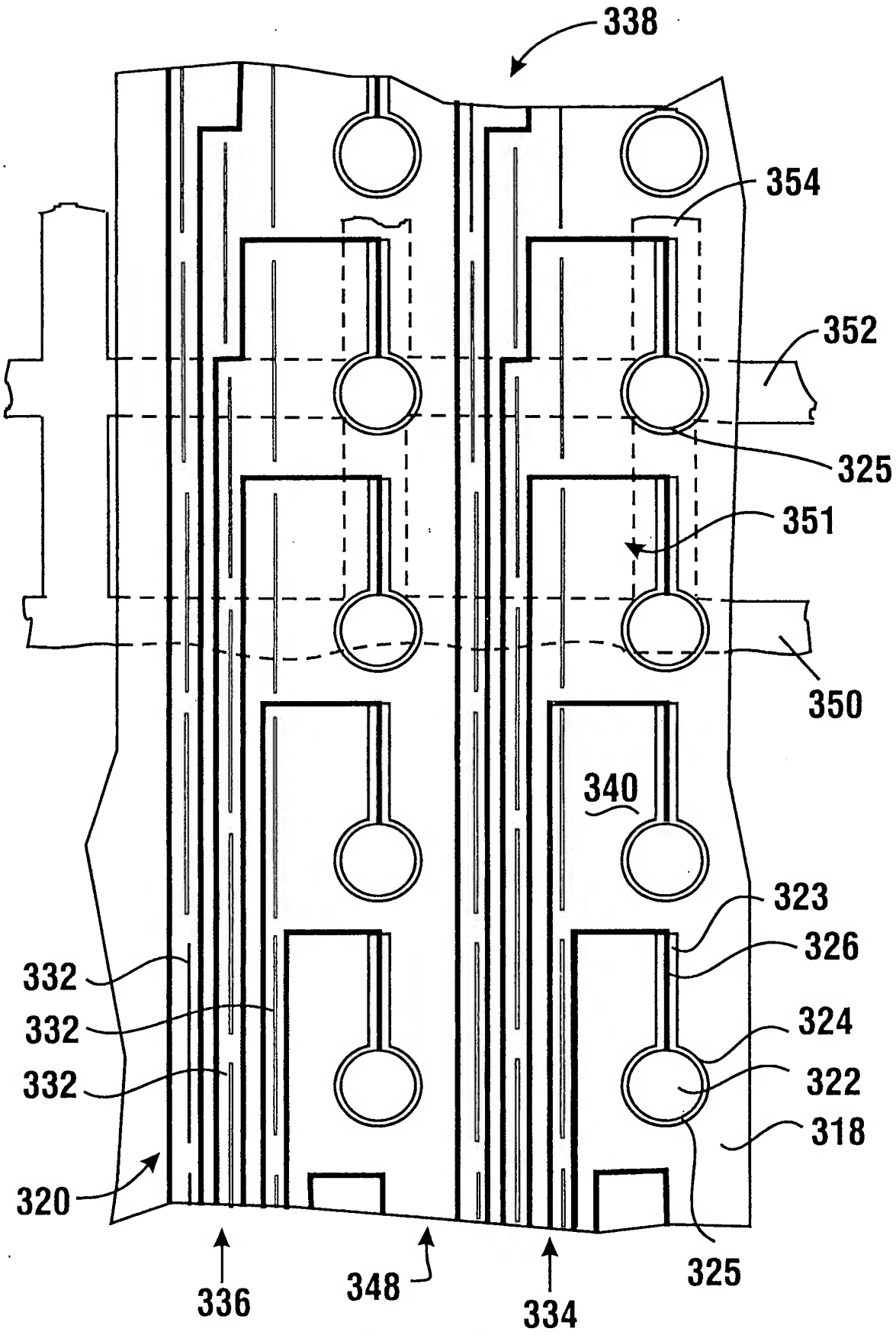
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FIG. 46

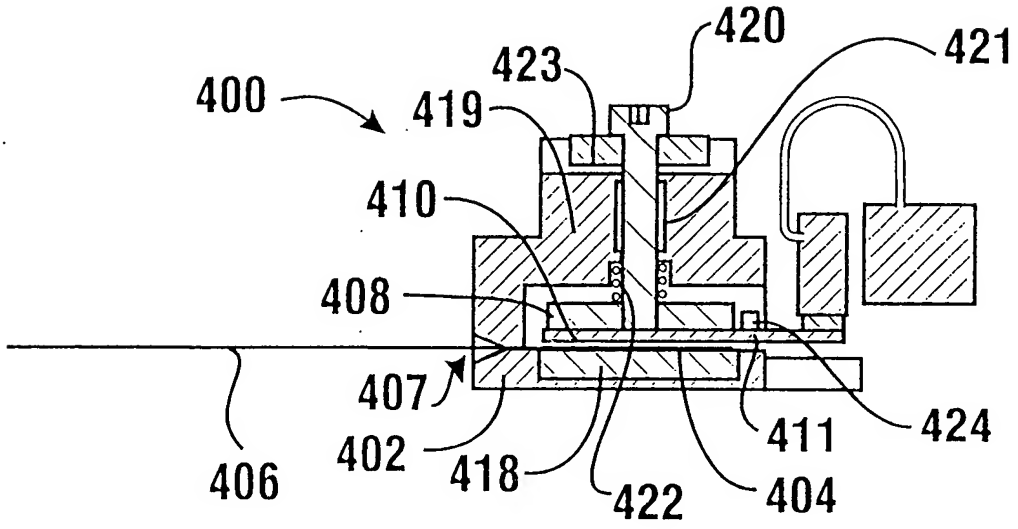
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FIG. 48

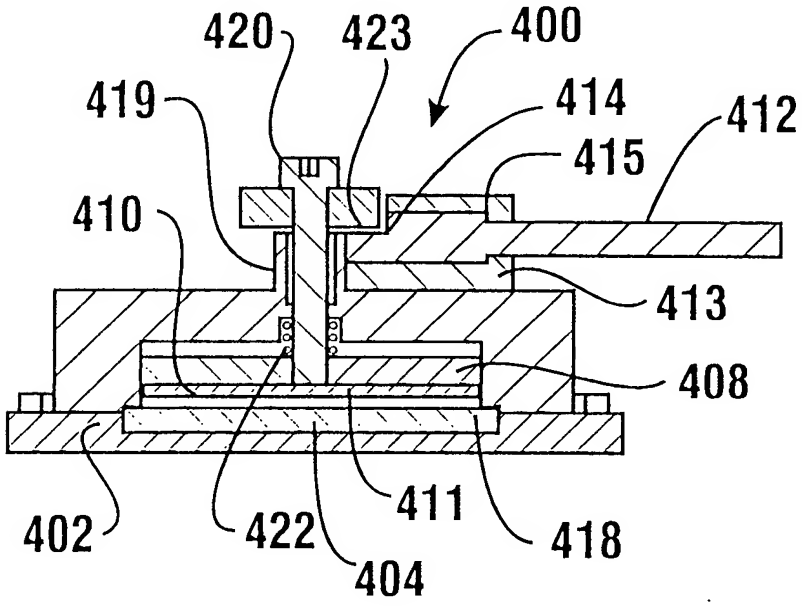
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FIG. 49

FIG. 50

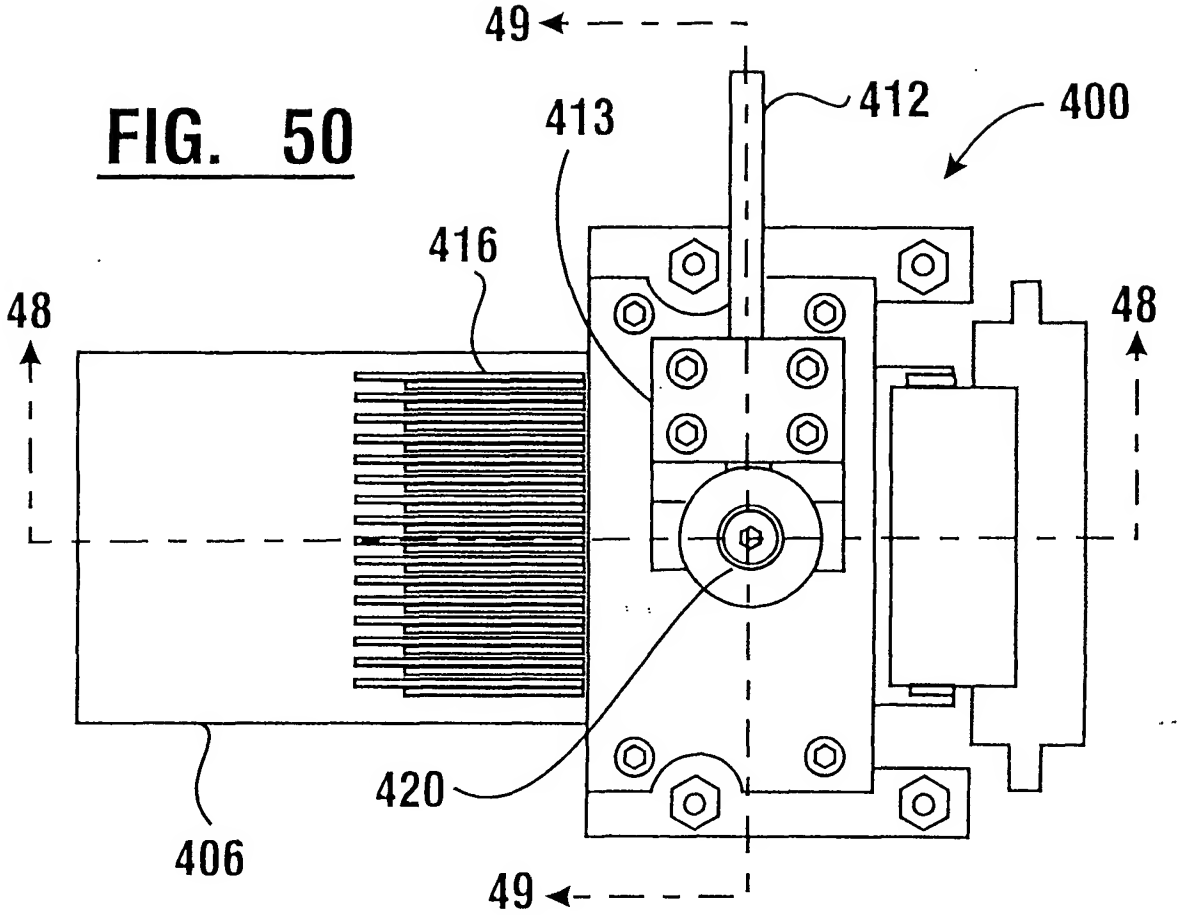
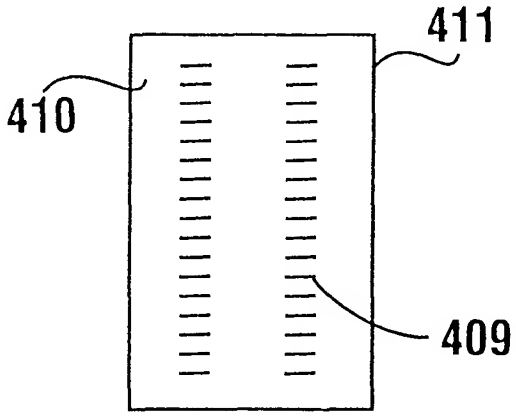


FIG. 51



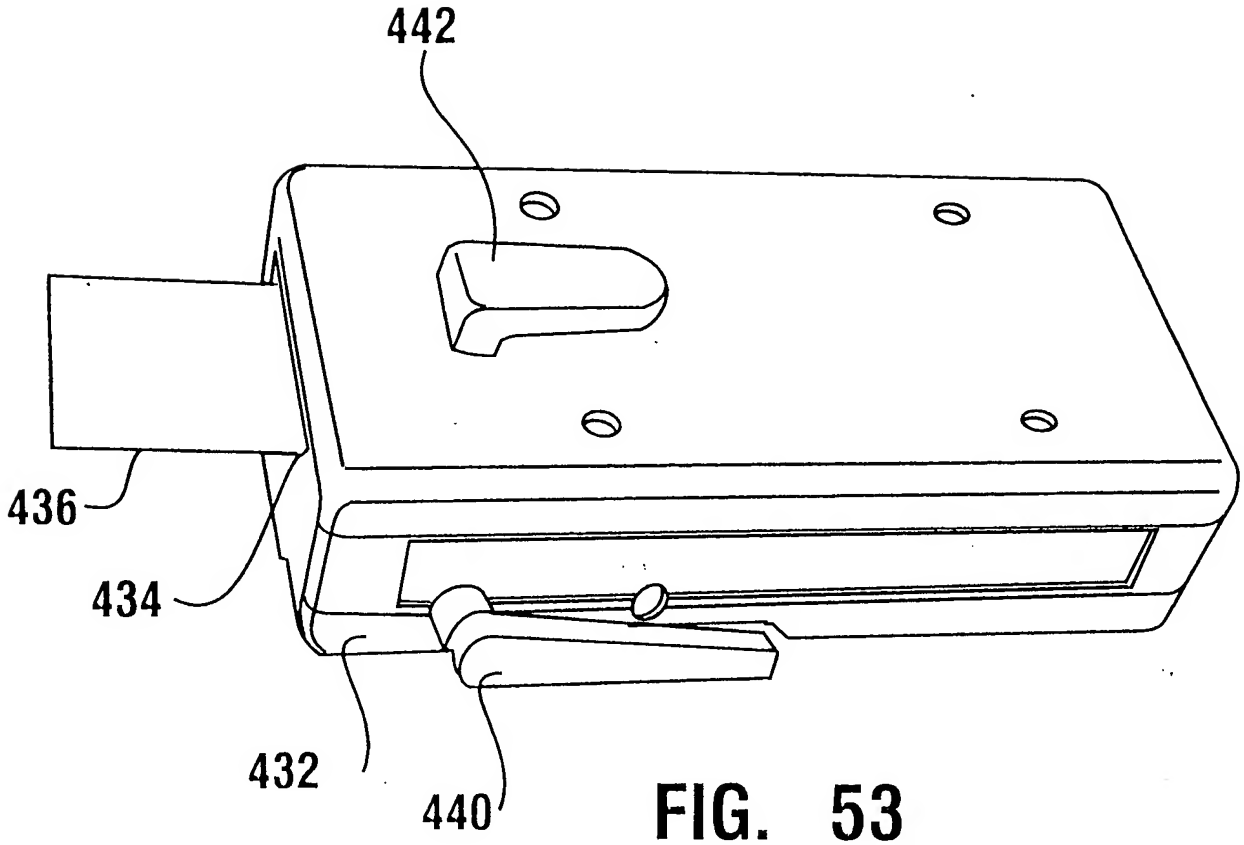


FIG. 53

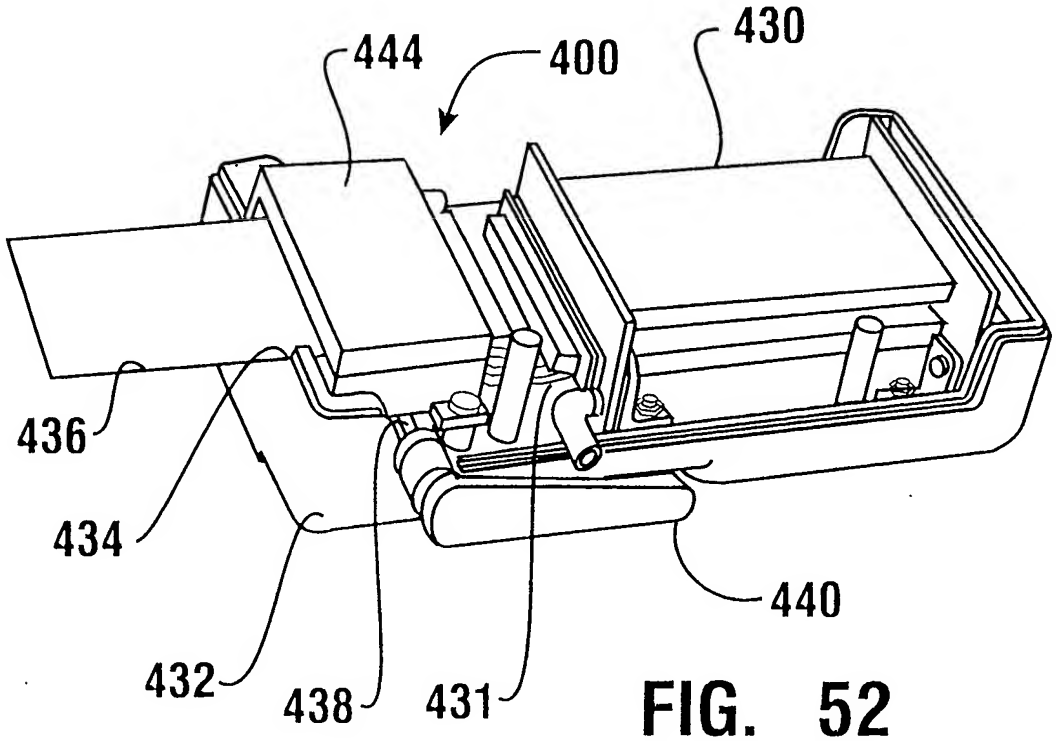


FIG. 52